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A Contribution to the Bacteriology of Wool

By ARTHUR L. SMITH

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There are two general methods of scouring wool: namely, by solvents, and by soap and soda ash. In the solvent scour, there is little reason to consider bacterial action. In the soap and soda ash scour, the liquors contain many bacteria of various kinds. When allowed to remain in the finished product, some bacteria may cause serious damage by weakening and embrittling the wool and by causing white spots in the dyed product. Since a knowledge of these bacteria and their reactions might prove of value in combating them, and since they might conceivably come from the scouring process, it was decided to try to determine the species present in the scouring liquors.

As the soap and soda ash type of scouring was carried out in open containers, it was quite logical to expect that many of the organisms present would come from the air. There were also the possibilities that they came from the sheep or were picked up by the wool in transit. If the first were true, it should be easy to identify the organisms, and the point would be quickly settled.

Two samples of scouring liquors were obtained, each about six hours old. One was a sample of liquors from the first bowl of a train scouring pulled wood (A); the other was from the first bowl of a train scouring grease wool (B). Separation by the dilution method was tried without much success. The streak method was finally adopted. Throughout the early part of this work, ordinary nutrient agar was used, and conditions were strictly aerobic so that any anaerobes present were automatically eliminated.

Ten colonies, five from each sample, were chosen as being sufficiently dissimilar to warrant determination. In the following tabulation, the capital letters refer to the sample; the small letters merely differentiate one organism from another as picked from the agar plates. All species were isolated November 10, 1931. Where observation by comparison was necessary as in temperature relationships, motility, etc., a 24-hour culture was used. For agar and broth tests where either there was growth or there was no growth, 48-hour cultures were used.

Aa. Plate: Yellow, convex to umbonate, circular, finely granular, butyrous.
Broth: Very slight growth.
Stain: Gram positive spheres singly and in clusters.
Slant: Heavy, white when new to yellow when old echinulate, butyrous.
Gel. stab: Infudimuliform to saccate.
Temperature: 37° C. better than 25° C.
Lactose broth: No gas; very granular growth.
Dextrose broth: No gas or acid.
Milk: No action.
Potato: No growth.
Nitrate broth: No growth.
Tryptophane broth: No growth.
Family Coccaceae.
Tribe: Micrococceae.
Genus: Staphylococcus.
Species: ?

Ab. Plate: Flat, white, irregular edges, heavy growth. Butyrous to viscous.
Broth: No surface growth. Liquid slightly cloudy. Abundant compact subsurface growth.
Stain: Gram positive rods in chains. Endospores.
Slant: Heavy growth, medium luster, opaque, echinulate.
Gel. stab: Infundibuliform to stratiform.
Temperature: 25° C. better than 37° C.
Lactose broth: No gas; very heavy, ropy growth.

Dextrose broth: No acid or gas.
Milk: Litmus red; milk curded.
Non-motile: Tendency to clump.
Potato: No growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Ac. Plate: White, convex, circular, butyrous to viscid.
Broth: Strong, flaky growth.
Stain: Gram positive rods singly; endospores.
Slant: Thin grayish, translucent, echinulate growth. Metallic luster.
Gel. stab: Saccate.
Temperature: Mesophilic.
Lactose broth: No gas; slight, viscid sediment.
Dextrose broth: No acid or gas.
Milk: Gelled; litmus red.
Non-motile.
Potato: Very slight growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Ad. Plate: Thin, white, circular growth; finely granular.
Broth: Cloudy (heavy growth); sediment viscid.
Stain: Gram negative rods singly; no spores.
Slant: Thin, gray to yellowish, opaque, echinulate.
Gel. stab: Saccate.
Temperature: 25° C. better than 37° C. Growth questionable at 50° C.
Lactose broth: No gas; slight, viscid sediment.
Dextrose broth: No acid or gas.
Milk: Unchanged.
Non-motile.
Potato: No growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacteriaceae.
Tribe: Bacterieae.
Genus: ?
Species: ?

Ae. Plate: Medium, white, convex, circular, finely granular, viscid.
Broth: Turbid growth with heavy, flaky subsurface growth.
Stain: Gram positive rods singly; endospores.
Slant: Thin, grayish, translucent, dull, echinulate.
Gel. stab: Crateriform.
Temperature: 37° C. better than 25° C. Growth questionable at 50° C.
Lactose broth: No gas; medium granular sediment.
Dextrose broth: No acid or gas.
Milk: Gelled; litmus unchanged.
Non-motile.
Potato: Slight white growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Ba. Plate: Grayish-white, translucent, umbonate, edges uniform, viscid.
Broth: Thin pellicle, flocculent (turbid).
Stain: Gram positive rods singly and in chains; endospores.
Slant: Medium dirty-white (brownish edges), dull, echinulate to beaded.
Gel. stab: Napiform.
Temperature: 37° C. better than 25° C.
Lactose broth: No gas; medium granular sediment.
Dextrose broth: No acid or gas.
Non-motile.
Potato: No growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Bb. Plate: Very heavy, raised, irregular surfaced growth. White turning to pink in two to three days. Butyrous.
Broth: Membranous pellicle; slight flaky subsurface growth. Pellicle white to pink.
Stain: Gram positive rods singly; endospores.
Slant: Thin, white (pink center), dull, spreading, translucent.
Gel. stab: Crateriform.
Temperature: 37° C. better than 25° C. 50° C. best. Growth at high temperature beaded to echinulate.
Lactose broth: No gas; heavy pellicle.
Dextrose broth: No gas.
Non-motile.
Potato: Medium, white to brown growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.
Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Bc. Plate: Heavy, white, opaque, raised to umbonate, edges irregular, viscid.
Broth: Strong, membranous white to pin pellicle. Slight flaky subsurface growth.
Stain: Gram positive rods; endospores.
Slant: Heavy white, opaque, lustrous, echinulate to beaded.
Gel. stab: Crateriform to stratiform.
Temperature: 37° C. better than 25° C.

Lactose broth: No gas; medium thin pellicle.
Dextrose broth: No acid or gas; heavy pellicle.
Non-motile.
Potato: Medium white to brownish gray growth.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.

Family: Bacillaceae.
Tribe: .....
Genus: Bacillus.
Species: ?

Bd. Same as Bc.

Be. Plate: Heavy, white, opaque growth, coarsely granular, slightly raised, viscid.
Broth: Very heavy, flocculent pellicle, viscid, medium subsurface growth.
Stain: Gram negative rods singly.
Slant: Very heavy, white, opaque, dull to medium luster, echinulate.
Temperature: 37° C. better than 25° C. Brown growth at 37°C. Poor growth and no color at 50° C.
Lactose broth: No gas; heavy pellicle.
Dextrose broth: No gas.
Motile.
Potato: Heavy white growth becoming brown with age.
Nitrate broth: Reduced without foam.
Tryptophane broth: No indole formed.

Family: Bacteriaceae.
Tribe: Bacterieae.
Genus: ?
Species: ?

As indicated, Bc and Bd were the same, but all others were different from this and from each other. Aa resembled Staphylococcus aureus in every way except in the nitrate broth and in the tryptophane broth where there was no growth. It might, therefore, be considered a species closely related to Staphylococcus aureus. Note that Ab, Ac, Ae, Ba, Bb, and Bc were Gram positive rods showing spores.

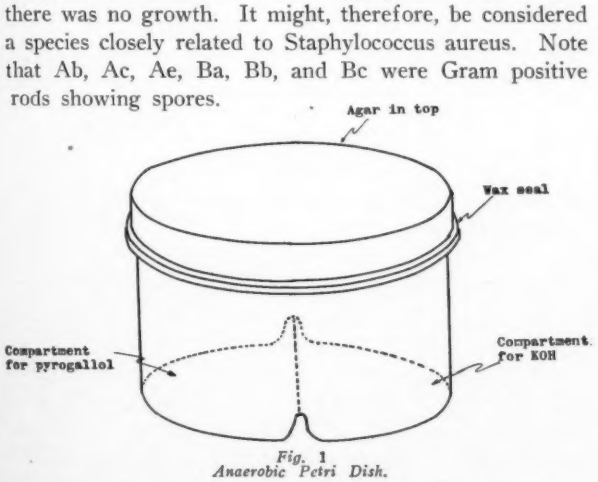

Fig. 1
Anaerobic Petri Dish.

Attempts were made to isolate the anaerobes if any were present. A special petri dish such as that shown in Fig. 1 was obtained for this work. One compartment was filled with solid pyrogallol, the other with concentrated potassium hydroxide solution. The agar was placed in the top half and streaked. The two halves were sealed together with wax and the dish gently rotated in order to mix the pyrogallol and the potassium hydroxide solution. The dish was then placed in an incubator.

Such a method insured almost complete removal of oxygen so that anaerobic growth should be favored. This meant another supply of oxygen for the organisms, and 0.5% dextrose agar was used. Several trials were made but in no case was there any growth. This must be attributed to the lack of atmospheric oxygen and not to the dextrose agar since the same agar, when used aerobicly, supported a luxuriant growth.

As a further check upon the source of the organisms, a sample of grease wool was obtained and scoured in the laboratory in a closed container. An analysis showed the same species as those already found.

Discussion

In considering these data, it must be kept in mind that although the nine species found were fairly definite in their actions, it is not to be inferred without proof that these same nine species or any combination of them will be found in every sample of wool or scouring liquors.

There are several points of interest. First, it will be noted that none of the bacteria corresponded to any species as listed in Bergey's "Determinative Bacteriology." This would seem to indicate that the organisms did not come from the atmosphere of the scouring mill. This might have been predicted from the fact that the pH of the scouring liquors averages about 11.0 to 11.5. This was further born out by the fact that the same species were obtained from scouring liquors in which wool had been scoured in the absence of air. Caution should be used in interpreting these data because they do not prove that bacteria from the air never get into the scouring liquors but that not all the bacteria present in the liquors come from the air of the scouring mill.

Second, the organisms from the two samples of liquors were different. This could be explained by assuming that some of the organisms were washed out of the pulled wool during the preliminary washing of the skins at the pullery. However, it is more likely to be due to the fact that the two samples of wool were from different localities.

The organisms seemed to give different reactions to temperature. G. Rice[1] states, "Heat is destructive to all germ life. The spore can thrive in icy temperatures but will succumb in hot ones." This is a little misleading. It is common knowledge that one species of Clostridium botulinus can withstand a temperature of 120° C. for four minutes when in the spore stage. Of the species found, some seemed to grow best at 50° C. which is a common scouring temperature. Those whose growth was questionable at 50° C. were not necessarily dead. Therefore it would seem well to say that the thermal death point of bacteria varies from species to species. That is, a temperature that will kill one species in a definite time may or may not kill another species in that length of time.

(Continued on page 509)

Specification of Color on Dyed Fabrics by Spectroanalysis*

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By a modification of its sample holder, the General Electric Recording Color Analyzer has been made applicable to analysis of color on fabrics. A program of work for applying spectroanalysis to color on fabrics is described, covering recording of color produced by individual dyestuffs, standard color lines, commercial matches, loss of color during fastness tests, and calculation of dye formulas.

THE files of a textile manufacturer contain many thousands of samples of dyed fabrics, either retained as standards for color lines or in connection with dyeing formulas which they illustrate. As standards for commercial production, such samples are frequently open to suspicion of having become soiled or faded, and a permanent record of the original condition of a sample would prevent occasional disputes from this cause. Since commercial matches usually deviate in some degree from the standard, some numerical measure of the discrepancies would be of great value in establishing tolerances. Moreover, a numerical record defining a color should be of value in systematic filing of the samples.

A spectrophotometric analysis of the light reflected from the colored sample is to the physicist the most satisfactory record and definition of the appearance of the sample. Whether the interpretation and use of such data by a textile manufacturer would be practicable has been open to question, but the time-consuming and expensive methods of color analysis which until recently were the only ones available prohibited any extensive practical trials. The invention of automatic recording color analyzers, notably one by Professor Arthur C. Hardy at Massachusetts Institute of Technology, subsequently developed and marketed by the General Electric Company, has radically simplified the task of preparing the spectrophotometric curves.

The purpose of this paper is to describe the experience at the laboratory of Cheney Brothers in recording the colors of fabric samples in terms of spectrophotometric curves using the General Electric recording color analyzer with modifications noted below.

The recording color analyzer has been described elsewhere by Hardy[2], and a general description will not be repeated. The machine, as delivered to Cheney Brothers' laboratory in January, 1930, was arranged to view an area of the sample about 1 mm. wide and 18 mm. long. The sample was held in a fixed position. It was found at once that this band of illumination was too narrow to give a representative view of a fabric sample, for marked shifts in the recorded curve occurred with changes in the position of the sample. This was particularly serious in a fabric with a distinct rib effect such as a bengaline, but it was found that even in comparatively smooth weaves the surface irregularities were sufficient to cause noticeable shifts in the position of the curve corresponding to changes in brightness with slight rotary shifts in the position of the sample in the sample holder. The manufacturer changed the optical system so as to increase the width of the area illuminated to approximately 3 mm., effecting some improvement. There still remained difficulty in obtaining reproducible readings because of vertical shifts in the curve resulting from slight rotation of the sample when replaced in the holder. Figure 1 illustrates the curves obtained from a sample of fabric when viewed in two positions 90 degrees apart. In the case of a satin this difference has been observed to be as much as 55 per cent.

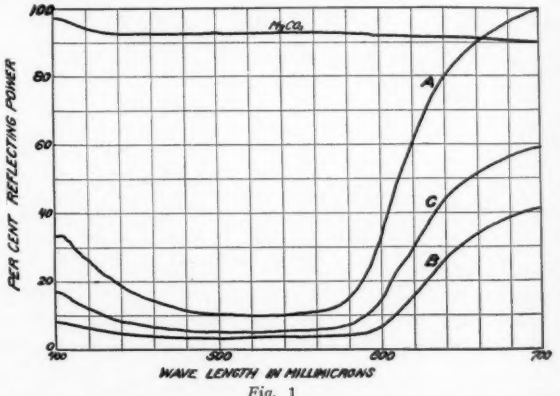

Fig. 1
Curves for a sample viewed in two positions 90 degrees apart. A—Warp vertical in stationary sample holder. B—Warp horizontal in stationary sample holder. C—Sample rotated.

Rotary Sample Holder

Following a preliminary demonstration of an experimental rotary sample holder by the General Electric Company, an inexpensive sample holder of this type was constructed and has proved highly satisfactory. Its construction is shown in Figure 2. A circular sample of fabric about 25 mm. in diameter is cut out with a die and placed behind a glass window in the holder which is mounted on the end of the shaft of a small motor. To correct for possible error due to viewing the sample through glass, the magnesium carbonate standard is cut

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[1] Since Feb. 15, 1932, research chemist for the Tannin Corp., 100 E. 42nd St., N. Y. C.

in the shape of a thin disk which may be slipped into the sample holder behind the same glass window. The motor is so mounted in the cabinet of the color analyzer that the light strikes the sample at 90 degrees and is taken off at 45 degrees exactly as in the original fixed sample holder, the only difference being that the sample is rotated continuously. Experiments showed that the speed of rotation may vary over a wide range, and it is only necessary to avoid certain critical speeds at which synchronism with the flicker wheel occurs and a stroboscopic effect results. When this occurs, it is at once evident from the motion of the recording pen and can be stopped by a change in speed of the motor. A rheostat is installed in the motor circuit for this purpose. Motor speeds between 3000 and 10,000 r. p. m. were tried, and the lower speeds were found satisfactory.

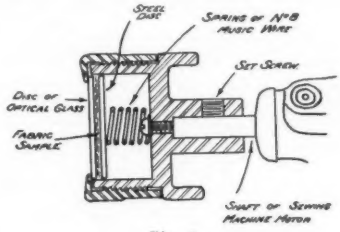

Fig. 2
Rotating sample holder.

Referring again to Figure 1, there is shown the curve for a rotated sample as compared with curves obtained for the same sample viewed in two fixed positions 90 degrees apart. Figure 3 shows curves of samples of a satin and a crepe which were taken from goods accepted as a commercial color match. These illustrate the difficulty of comparing curves obtained with samples held in a fixed position and the good agreement of curves obtained from rotating samples. This confirms our assumption that the practical color matcher, when called upon to match fabrics of strikingly different construction, consciously or unconsciously matches the average appearance of one sample to that of the other with practically the result obtained by rotation in the color analyzer.

Calibration of Color Analyzer

The color analyzer is calibrated and its correct adjustment is checked not only by running curves for magnesium carbonate, but by transmission curves for two glasses of known transmission values, one blue and one red. It has been the practice to make these tests once a day, keeping a permanent file of the curves obtained. All measurements made upon samples submitted are dated so that they may at any time be compared with the calibration curves for that day. Experience has shown that the calibration curves do not shift appreciably during any one day, so it has not been necessary to run them for each fabric sample tested. For convenience in subsequent calculations, the curve for magnesium carbonate is generally recorded on the sheet with those of samples analyzed.

Preparation of Fabric Samples

It will be appreciated that satisfactory results depend not only upon the performance of the color analyzer but also upon the preparation of the sample. In trying to define a dyestuff, not in terms of a sample of the dyestuff as obtained from the manufacturer but in terms of its color value when applied to a sample of fabric, the dyeing technique is exceedingly important. In dyeing silk, perfect exhaustion does not usually occur in the laboratory and is seldom obtained in plant practice. Reproducibility of dyeings depends, therefore, upon exceedingly accurate standardization of the dyebath and the whole procedure for dyeing.

In spite of marked improvement in dyeing technic acquired through the necessity for reproducibility and the evidence shown by the color analyzer of frequent deviations in dyeing uniformity, it is believed that at present the limiting factor in accuracy in these experiments is in application of the dyestuffs to the fabric rather than in the measurements obtained with the color analyzer. It is safe to say that one by-product of real value from the experience in this laboratory with the color analyzer has been the growth of a consciousness of the possibility of more exact reproduction of dyeings and a resulting general improvement in laboratory practice.

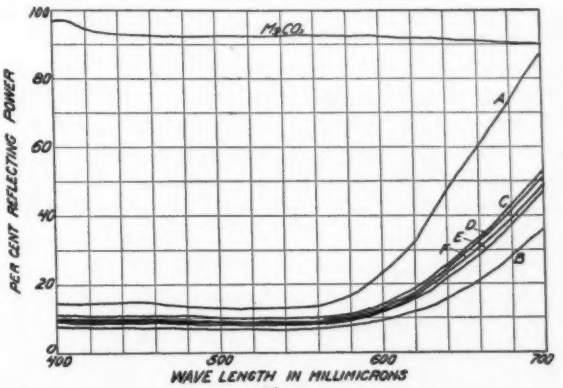

Fig. 3
Comparison of colors on satin and crepe silks. A—Satin with warp vertical. B—Satin with warp horizontal. C—Satin rotated. D—Crepe with warp vertical. E—Crepe with warp horizontal. F—Crepe rotated.

In the case of samples of fabrics obtained from mill production or from outside trade, there has been a limitation in the application of the color analyzer owing to the area of sample required for examination. Not only is a circular sample 25 mm. in diameter used in the present sample holder, but several thicknesses of the material have been necessary to avoid errors due to the light passing through the sample. In the case of thin goods such as voiles, as many as sixteen thicknesses have been found necessary, although in most fabrics three or four layers are sufficient. Printed designs seldom offer large enough areas of a given color to furnish the necessary samples. In piece dyed goods there is no trouble provided sufficient material has been submitted for test.

At the time of this publication, although some measurements of color on yarn samples have been made, a completely satisfactory method of mounting the yarn sample has not been developed. The construction of the

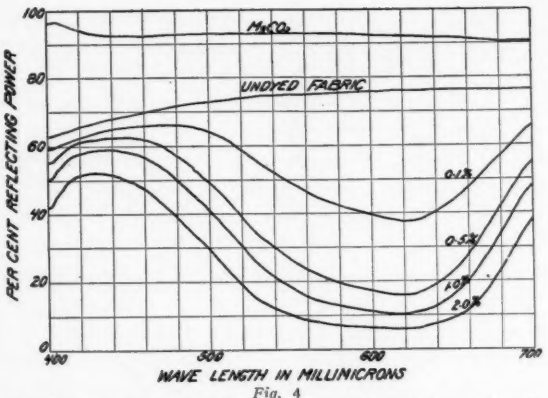

Fig. 4
Family of curves for Brilliant Wool Blue FFR applied on silk crepe.

sample holder made it convenient to pack the space behind the glass with small bits of fiber clipped from the sample, but it was demonstrated that the curve obtained varied with the fineness of cutting of the yarn, and a more representative curve would be had if all the yarn fibers could be stretched smooth and flat behind the glass of the sample holder. With a larger sample holder in which a square card could be mounted, this condition could readily be obtained using several layers of yarn wound around the card.

Application in Plant Control

Having obtained results with the color analyzer which indicated that under certain conditions significant curves could be obtained from fabric samples, the following outline was made as a program of work for establishing the use of the color analyzer in control testing in textile manufacture:

I. Records of individual dyestuffs.
  a. To assist in controlling quality of dyes purchased.
  b. To furnish data for calculation of dye formulas.
II. Records of regular color lines.
III. Records of matches obtained in commercial production.
  a. To accumulate data for tolerances in deviations from standard color lines.
IV. Records of wash tests and light tests on individual dye stuffs and standard color lines.
  a. To accumulate data on which to establish tolerances for loss of color during these tests.
V. Calculation of formulas in terms of two or more dyestuffs required to produce a color on fabric form which a given spectrophotometric curve will be obtained.

I. Record of Individual Dyes

For this purpose dyeings were made on a crepe fabric with each of the commonly used dyestuffs. Dyeings were made in each case with a series of percentages of dye (calculated, as is customary in dyeing practice, on the weight of the fabric sample). The values taken were 0.1, 0.5, 1.0, 2.0, and 4.0 per cent. Of this series the 2.0 per cent dyeing was chosen as a standard of comparison for shipment testing.

As a rule, a shipment of dyestuff which is within 5 per cent of the concentration guaranteed by the manufacturer is satisfactory provided the hue is correct. The increasing application of standardized dyeing in which a definite dyeing formula is supplied the dyehouse by the laboratory has made it necessary to keep strictly within these limits, a shipment of higher concentration being just as objectionable as one of lower concentration. Thus far, in shipment-testing, judgment has been passed first by the eye, and only those shipments which seem questionable have been tested further on the color analyzer to attempt to evaluate the exact percentage deviation or to prove a discrepancy in hue.

As mentioned above, curves were obtained for a given dyestuff at a series of different percentage dyeings, all being recorded upon one sheet of paper as illustrated in Figure 4. Since the light absorbed by the dyed sample is

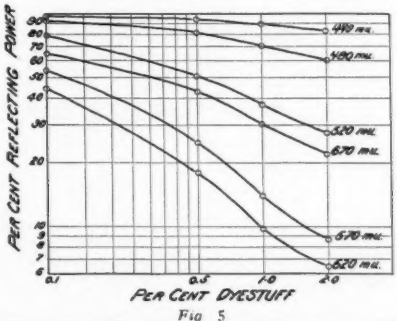

Fig. 5
Data for Brilliant Wool Blue FFR replotted from curves of Figure 4 after correcting for magnesium carbonate as 100 per cent reflection and for color from undyed fabric.

proportional (over a limited range of concentrations) to the logarithm of the concentration of dyestuff taken up by the fabric, it is convenient for purposes of interpolation to plot this data over on another sheet as illustrated in Figure 5. In order to include the range of values most conveniently, log concentration has been plotted against log reflection. In Figure 5 each curve represents the reflection at any concentration at a given wave length. The curves thus obtained are used in interpreting deviations in color-analyzer curves in terms of per cent dyestuff involved, applying both in estimations on faulty shipments of dyes and in calculation of dye formulas to correspond to given spectrophotometric curves.

II. Records of Regular Color Lines

The collection and filing of curves for all colors offered for sale in the various fabrics is largely a routine type of test. This is being done for current production, and the resulting curves serve as permanent records and as standards with which questionable matches from commercial production may be compared. The authors have postponed trying to develop a filing system based on values to be derived from these curves, feeling that this can be undertaken most conveniently when a large number of measured samples has been collected. The simplest system to suggest itself consists of designating each color by a number derived from the ordinates of the curve at a num-

ber of arbitrarily chosen wave lengths. (The present practice is to designate colors in the manufactured line by numbers which have no significance whatever.) A numerical expression in terms of three excitation factors calculated from the curve would be still more significant, but as is pointed out later, the calculation involved is somewhat slow and tedious.

III. Commercial Matches

For a time analyses were made of samples obtained from each dye lot in commercial production and compared with the standard sample each was intended to match. In the case of 130 consecutive dye lots, only one lot had been criticized as off-shade by the regular inspectors, and curves obtained with the color analyzer indicated only one lot aside from this one to be very questionable. Since records of poor matches were more useful than those of satisfactory lots because the data was to be used for correlation between the discrepancies in the curves obtained by the color analyzer and the opinion of the regular inspectors on poor matches, it was necessary to dye up in the laboratory a series of approximately matched samples varying in exactness of match and have them classified by the inspectors.

It was also necessary to supply some simple numerical expression for the difference between two curves. When the two curves are practically parallel, as in the case in Figure 6, the difference is one of brightness only and

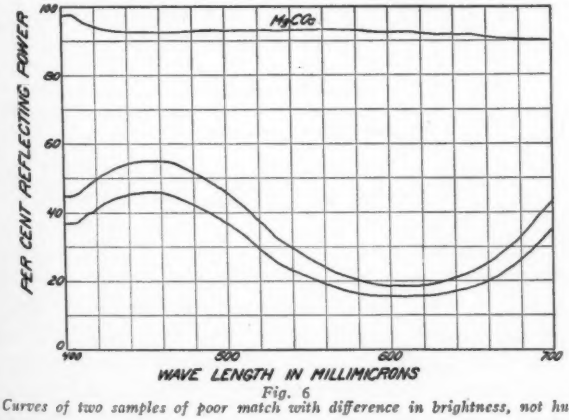

Fig. 6
Curves of two samples of poor match with difference in brightness, not hue.

may be expressed in terms of the difference in per cent of reflection at some one wave length, or, if preferred, in terms of the difference in area beneath the two curves.

When the discrepancy is due to hue difference, it cannot be expressed so conveniently. A typical case is shown in Fig. 7. Here it is necessary to follow the procedure of multiplying successive ordinates along the curve by the values at corresponding wave lengths for each of the three curves for the excitation factors, as established by the Optical Society of America[3], and obtaining three new curves the areas under which may be represented by simple numbers. This is a tedious procedure, requiring from one-half hour to one hour for a single curve, but will undoubtedly be simplified by the development of a mechanical integrator if industrial application brings about sufficient demand for such assistance. The integration has been facilitated by having a supply of forms printed in which the series of corrected ordinates may be entered. Figure 8 shows this form in which are entered the data from Figure 7. It should be mentioned here that in any of these calculations the curve recorded by the analyzer must first be corrected, point by point, dividing by the ordinate of the magnesium carbonate curve at that wave length and the multiplying by 100.

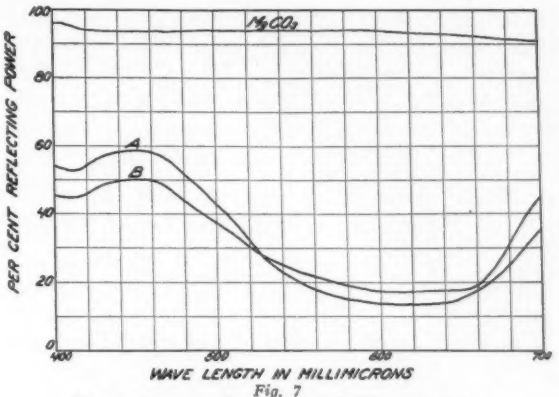

Fig. 7
Curves of two samples poorly matched because of hue.
Physiological stimuli calculated from O. S. A. excitation factors.

	Violet	Green	Red
A	228561	63599	47940
B	192284	65150	52366
Diff. %	15.9	2.4	13.4

When two curves for a match in question are each converted into excitation factors by the calculation outlined above, there are obtained three pairs of values, any or all of which may differ. If the two numbers in all three pairs agree closely, the samples must appear alike to the normal eye. In all poor matches the numbers in one or more of these pairs differ markedly. Thus far the largest percentage difference found between corresponding excitation values has been taken as the expression of the difference between two such samples. To illustrate, if the difference in the blue is greater than that in either the green or red, the latter is disregarded and

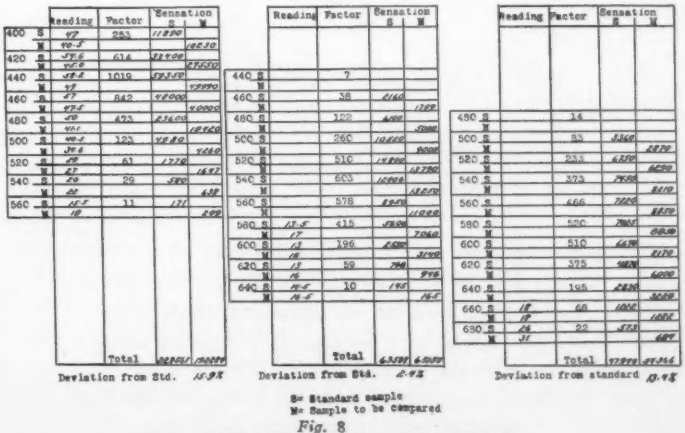

Fig. 8
Form used for calculation of excitation values.

the difference between the samples expressed entirely in terms of the blue excitation values. This is only an approximation, but thus far it has proved satisfactory enough.

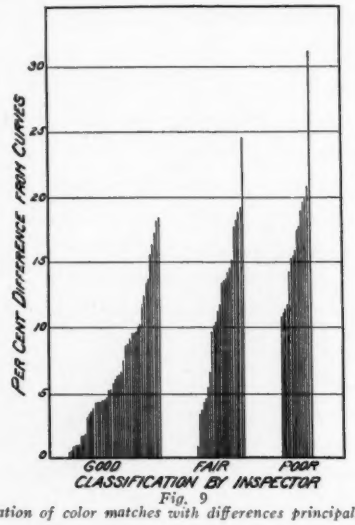

Fig. 9
Graphic correlation of color matches with differences principally of brightness.

Figures 9 and 10 show graphically the correlation in a considerable number of cases in which the judgment of regular inspectors has been compared with the measurements obtained with the color analyzer. They show rather a surprising tolerance on the part of the trade. The allowable discrepancy appears greater when the difference is one of brightness than when hue is involved. It must be appreciated that the severity or laxity of the inspector in judging matches is a direct indication of the tolerance allowed by the trade. The consistent use of the color analyzer to assist the inspector in passing doubtful lots would do much to establish a more uniform standard for color matches.

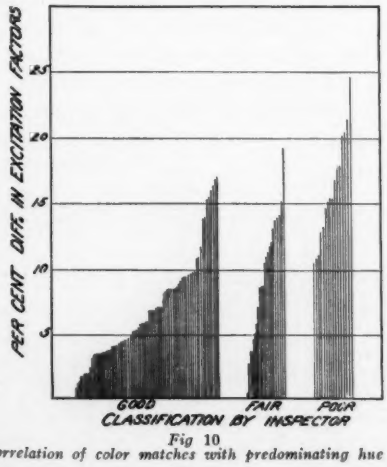

Fig 10
Graphic correlation of color matches with predominating hue differences.

The use of the color analyzer has proved especially valuable in comparing goods of radically different construction in which individual persons frequently disagree as to whether or not a satisfactory match has been obtained. Attempts have been made to use measurements of dyed yarns to compare with measurements of the color in the fabric obtained from the yarns, but a completely satisfactory method of mounting the yarn sample has not been obtained.

IV. Records of Samples After Fastness Tests

Wash Tests. Good washability of fabrics has come to be more and more expected by the customer, and in the case of silks very marked improvement in washability has been shown within the last 5 years. Standard methods of making wash tests have been fairly generally adopted, but the decision as to the degree of loss of color through the washing operation has been left to estimation by eye.

Since the change in appearance of a properly dyed fabric after washing is chiefly one of brightness, it is comparatively simple to apply the color analyzer to obtain a numerical expression for the loss of color during this test. Typical curves from samples before and after wash test are shown in Figure 11. It is only necessary

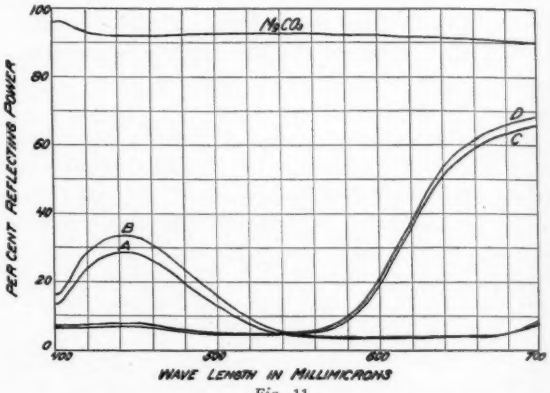

Fig. 11
Curves of samples before and after wash tests. A—Victoria Blue B before washing. B—Victoria Blue B after washing, showing unsatisfactory fastness. C—Erie Scarlet 3B before washing. D—Erie Scarlet 3B after washing, showing satisfactory fastness.

to express the change in terms of per cent difference in reflectance at anyone wave length. It should of course be kept in mind that the color analyzer can give only a numerical value to the change that takes place during such a test, and the trade will establish the tolerances based upon commercial practice. However, a tolerance which can be expressed in numerical values is certain to become more uniform and less likely to lead to misunderstanding and disputes.

Lightfastness Tests. Experiments on the fastness of the dyed samples to light were based on exposures to a carbon arc light in the Fade-Ometer. These curves are not so simply interpreted as those for wash tests, since in some cases there is a change in brightness, but more commonly the action of the light causes a distinct change in hue. Typical curves are shown in Figure 12. The same calculation for comparing curves for commercial matches may be applied to curves before and after light exposure.

V. Calculation of Formulas from Curves

This section has been included in the outline for a program for application of the color analyzer to textile

manufacture, but because the preceding steps obviously needed to be developed first and because at this time the ability to calculate the dye formula from the curve is of less practical than theoretical interest, there is no data to report here.

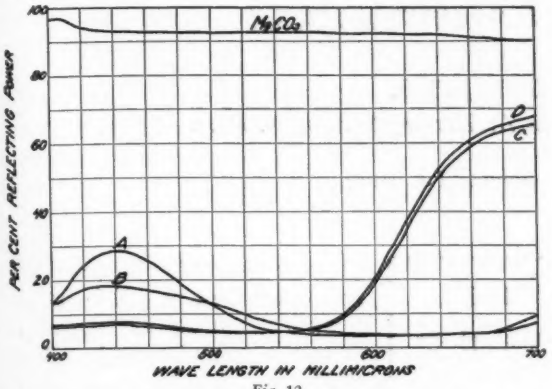

Fig 12

Curves of samples before and after light exposure. A—Victoria Blue B before exposure. B—Victoria Blue B after five hours in Fade-Ometer, showing objectionable change. C—Erie Scarlet 3B before exposure. D—Erie Scarlet 3B after twenty-five hours in Fade-Ometer, showing good fastness.

In one instance, however, in which goods are dyed by a continuous method (the Cohoe process) ordinary experience in dye application was not adapted to establishing the continuous feed bath required. A study of the substantivity of individual dyestuffs using the color analyzer has proved a solution for this problem and is reported in a paper by W. P. Cohoe[1].

Special Applications

For development work in the laboratory where experiments may be carried out under controlled conditions, the color analyzer is invaluable. A simple illustration of a laboratory use has been the establishing of a test for the tarnishing action of velvets intended for the jewelry box trade. The color of a disk of silver is recorded in the analyzer before and after a standard exposure in contact with the velvet sample, and from the two curves obtained there may be calculated a numerical grading of the tendency of the velvet to tarnish the metal.

Conclusion

The work described in this paper is still in progress, but since this program of development may be applicable in other fields and of greater general interest than any detailed and final results, the authors have felt justified in publishing this work at this stage. The expense of the color analyzer and the necessity of an operator with somewhat specialized training will probably limit its use in a plant dyehouse where a simpler form of color comparator is better adapted if and when it is necessary to supplement the trained eye of the dyer. Special laboratory applications and the use of the analyzer in mill control, particularly in establishing tolerances in commercial matches and for loss of color after wash and light tests, should justify a general recognition of spectrophotometric analysis in the textile industry in the near future.

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[1] Cohoe, W. P., and E. R., Ind. Eng. Chem., *Anal. Ed.*, *4*, 112 (1932).

[2] Hardy, A. C., *J. Optical Soc. Am.*, *18*, 96-117 (1929).

[3] Optical Soc. Am., Report of Committee on Colorimetry for 1920-21, *Ibid.*, *6*, 548 (1922).

Presented before the Division of Dye Chemistry at the 82nd Meeting of the American Chemical Society, Buffalo, N. Y., August 31 to September 4, 1931.

A Contribution to the Bacteriology of Wool

(Continued from page 503)

Summary

It has been shown that not all organisms present in wool scouring liquors come from the air of the scouring mill. Further, all organisms found in this particular piece of work were aerobic. Most of these were spore-formers and, therefore, would be more resistant to temperature than non spore-formers.

This last point is particularly worthy of note since it is conceivable that such organisms might resist the heat of the rapid drying given in processing and carry over to the finished, scoured product.

Reference

[1] G. Rice: Textile Colorist *52*, 748-9 (1930).

Chemists Club Golf Tournament

The first of the Chemists' Club golf tournaments for the President's Cup was held at the Rye Country Club, Rye, N. Y., on June 30th, with fifty-three members competing.

Frederick Kenney, Chief Chemist of the New York City Department of Purchase Laboratories, scored an 84 to take the prize for low gross; and D. P. Morgan, Jr., of Scudder, Stevens & Clark, was runner-up with an 89.

Low net honors were won by Elon H. Hooker, president of the Hooker Electrochemical Company, who played accurate golf to score 90-20-70. H. B. Bishop, president of the Sterling Products Company, was second with 111-40.71. The kickers' handicap was won by Edward L. Gordy, editor of "The Chemist," with Frank G. Breyer, of Singmaster & Breyer, second.

President George C. Lewis acted as toastmaster for the dinner, which was attended by some of the non-golfing members of the club. After speeches by H. O. Chute, Lewis Marks, and Harry Mabey, and a speech entirely in French by J. F. X. Harold, the prizes were presented by R. J. Quinn, chairman of the tournament.

Analytical Methods for a Textile Laboratory—Concluded

By **WALTER M. SCOTT, Ph.D.**

Consulting Chemist with Gustavus J. Esselen, 73 Newbury St., Boston, Mass.

(*Concluded from page* 496 *August* 1*st issue*)

No. 44 MAGNESIUM CHLORIDE $MgCl_2 6H_2O$

Magnesium

Determine as in Magnesium Sulfate (No. 45). Calculate as MgO.

Qualitative Tests

Test as usual for sulfates and iron

Average Analysis

Magnesium Oxide as MgO..19.7%

No. 45 MAGNESIUM SULFATE (Epsom Salts) $MgSO_4.7H_2O$

Magnesium

Weigh about 1 gm. of the sample into a beaker. Add 100 cc. of water, 10 cc. of ammonium chloride, 5 cc. of dilute HCl, and heat to boiling. Then add 50 cc. of normal disodium phosphate (Na_2HPO_4) sodium and 50 cc. of dilute ammonia. Stir thoroughly and then let stand over night. Filter on a gooch crucible, wash with weak ammonia (25 cc. dilute ammonia in 100 cc. water), ignite, and weigh as $Mg_2P_2O_7$. Multiply $Mg_2P_2O_7$ by the factor 0.3621 to obtain MgO.

Chloride

Test for this as usual and if present, determine by titration with N/10 silver nitrate.

Average Analysis

Magnesium Oxide as MgO..... 16.37%

No. 46 MONEL METAL

Stock Solution

Dissolve 1 gm. in 6 cc. dilute HNO_3 in a 6 oz. flask. Add 6 cc. of conc. H_2SO_4 to the solution and boil until all the HNO_3 is removed and copious white fumes are evolved. Cool and add 35 cc. of H_2O, warming to dissolve the sulfates completely, then filter into a 500 cc. graduated flask and make to volume.

Copper

Pipette 100 cc. of the stock solution into a 250 cc. beaker, add 10 cc. dilute H_2SO_4 and 5 cc. dilute HNO_3 and dilute to about 200 cc. Then place the weighed platinum electrodes in the solution and pass current (0.5 ampere) through for about 12 hours. Remove the electrodes, wash with distilled water, then a little alcohol, dry, and weigh.

Nickel

Pipette 25 cc. of the stock solution into a No. 4 beaker and add 300 cc. of water. Then add 1 gm. of citric acid, make the solution slightly ammoniacal and heat nearly to boiling. Then pour in slowly, with stirring, 25 cc. of a 2% solution of dimethyl-glyoxime in 95% alcohol, after which allow the solution to stand for an hour. Filter on a gooch and wash with water,. containing about 0.1% ammonia. Dry at 100° and weigh nickel dimethyl-glyoximine. Multiply by the factor 0.2031 to obtain Ni.

Iron

Pipette 100 cc. of the stock solution into a 16 oz. flask, add 1 gm. of pure granulated zinc and warm on the steam bath until the evolution of hydrogen practically ceases. Filter from the separated copper, cool the filtrate quickly and titrate with N/10 $KMnO_4$. Calculate as **Fe.** 1 cc. N/10 $KMnO_4$ = 0.0059 gms. Fe.

Average Analysis

Ni	68-72%
Fe	0.5-1.5%
Cu	27-32%

Traces of sulfur and carbon

No. 47 OIL—NEATSFOOT

Specific Gravity

Determine with the hydrometer at 15°C.

Saponification Value

Determine as in Olive Oil (No. 48).

Iodine Number

Determine as in Olive Oil (No. 48).

Free Fatty Acids

Determine as in Olive Oil (No. 48).

INTRODUCTION

The Research Committee of the American Association of Textile Chemists and Colorists has recently appointed a special sub-committee to standardize the analytical methods which are applied to the common chemicals and allied materials used by the textile industry. This action is indicative of the active interest in this particular subject among textile chemists at the present time. Therefore it seems to be an opportune moment to present a collection of such analytical methods which might serve as a basis for discussion in connection with the work of the above mentioned sub-committee. Dr. Scott has had an unusual opportunity to test the value of the methods which he proposes, during his ten years of service as Chief Chemist for Cheney Brothers, silk manufacturers. As an active member of the Research Committee of the A. A. T. C. C., he has kept in close touch with all recent developments along this line.

Unsaponifiable Matter

5 gms. of the sample are saponified by boiling with an excess of alcoholic potash (about 100 cc.) for 1 hr. The alcohol is then boiled off, about 100 cc. of water added and the solution transferred to a separatory funnel and extracted with three successive portions of ether. The ethereal solution is washed first with a 1% caustic solution, then with water, after which it is transferred to a weighed beaker or wide mouthed flask. The bulk of the ether is allowed to evaporate off spontaneously and the last traces are removed by heating for ½ hour in the oven at 85° C.

Average Analysis

Specific Gravity	0.915
Saponification Value	193-200
Iodine Number	66-74
Freey Fatty Acids	Under 1.5%
Unsaponifiable Matter	Under 0.7%

No. 48 OIL—OLIVE

Specific Gravity

Determine with the hydrometer at 15° C.

Saponification Value

1.5 to 2 gms. of the sample are treated with 25 cc. of N/2 alcohol potash in a flask fitted with a long vertical tube. The solution is boiled for ½ hour on the steam bath with frequent agitation until saponification is complete. The excess of potash is titrated with N/2 HCl using phenolphthalein as an indicator. Meanwhile a blank solution of 25 cc. of the potash is given the same treatment. The difference between the two titrations is used as the basis for calculating the number of milligrams of KOH required to saponify 1 gm. of oil.

1 cc. N/2 HCl = 28.05 mgms. KOH.

Iodine Number

Weigh into an eight-ounce glass stoppered bottle about 0.15 to 0.30 gms. of the sample, add 10 cc. of chloroform to dissolve the oil and then 25 cc. of the Hanus iodine solution. The latter should be accurately measured either with pipette or burette. Shake thoroughly and allow to stand in the dark (over night). Then add 10 cc. of 15% KI solution and 100 cc. of water and titrate with N/10 sodium thiosulfate until the iodine color is removed, shaking vigorously after each addition. A little starch paste may be added near the end to the titration to intensify the final change. Run a blank in the same manner as above, using 10 cc. of chloroform and 25 cc. of the iodine solution and calculate from this data the percentage of iodine absorbed by the oil.

1 cc. N/10 $Na_2S_2O_3$ = 0.0127 gms. iodine.

Free Fatty Acids

10 gms. of the sample are dissolved in 50 cc. of neutral 95% alcohol by heating on the steam bath with agitation. The solution is titrated with N/10 NaOH using Phenolphthalein as an indicator. Calculate as oleic acid ($C_{17}H_{33}COOH$).

1 cc. N/10 NaOH = 0.0282 gms. oleic acid.

Average Analysis

Specific Gravity	0.914-0.920
Saponification Value	185-196
Iodine Number	77-95
Free Fatty Acids	Under 1%

Qualitative Tests for Adulterations

Cotton-seed Oil (Halphen's Test):

Two or three cc. of oil are dissolved in equal volumes of amyl alcohol and a 1% solution of carbon disulfide, in a test tube. Immerse the test tube to half its depth in a boiling brine solution for about ten minutes. An orange or crimson color is produced with cotton-seed oil. If color does not appear, add more carbon disulfide and boil again.

Sesame Oil (Badonin's Test):

Take ten cc. of oil in a test tube, add 2 drops of a 2% alcoholic solution of furfural and ten cc. conc. HCl and shake well. In the presence of sesame oil the aqueous liquid will be rose to crimson in color. This test is sensitive to 1%.

Peanut Oil (Bellier's Test):

Solutions required: Alcoholic Potash—8.5 gms. KOH dissolved in 70% alcohol and made to 100 cc. volume. Acetic Acid—120 cc. of 36% acid diluted to 150 cc. volume. 1.5 cc. of this acid should exactly neutralize 5 cc. of the alcoholic potash.

Weigh 1 gram of the sample into a dry test tube, add 5 cc. of alcoholic KOH and boil gently over a small flame, holding the tube with a holder in the hand, until saponification is complete (2 min.), avoiding evaporation as far as possible. Add 1 cc. acetic acid, mix well and cool for at least thirty minutes (in tap water) shaking occasionally Then add 50 cc. of 70% alcohol containing 1% by volume of HCl (Sp. Gr. 1.16), shake well, and again place in water for one hour. If no arachis (peanut) oil is present, a clear opalescent liquid is formed; if more than 10% is present, a flocculent crystalline precipitate remains, even with 5% a distinct precipitate remains and separates on standing.

No. 49 OIL—RED

(Commercial Oleic Acid)

$C_{17}H_{33}.COOH$

Solidifying Point (Titer Test)

Fill a test tube about 2/3 full of the sample which has been previously warmed a little and fit it into a ring or collar so that it may be suspended in a bottle of cold water. Use ice if necessary. Fix a delicate thermometer so that the bulb is entirely immersed in the oil. When the oil begins to solidify stir occasionally and note the temperature at which the mercury remains stationary for at least two minutes.

Free Fatty Acid

Determine as in Olive Oil (No. 48).

Saponification Value

Determine as in Olive Oil (No. 48).

Specific Gravity

Determine with the hydrometer at 40° C.

Unsaponifiable Matter

Determine as in Neatsfoot Oil (No. 47).

Average Analysis of a Low Titer Red Oil

Specific Gravity	0.887-0.908
Solidifying Point (titer test)	63-65° F.
Free Fatty Acid (Calculated as oleic)	82-88%
Saponification Value	200-204
Unsaponifiable Matter	Less than 1%

No. 50 OILS—SULFONATED

Prepare 500 cc. of a 5% by volume emulsion in water.

Total Fatty Matter

Pipette into the test bottle 17.6 cc. of the above emulsion. Add 5 cc. conc. H_2SO_4 and centrifuge 5 minutes. Add a saturated solution of sodium sulfate to bring the liquid up into the graduated neck of the bottle and centrifuge 2 minutes. The reading should be multiplied by 2 to get the correct value for the % of fatty matter in the sample.

Acidity or Alkalinity

Determine the pH of the solution colorimetrically, and adjust the pH of a 200 cc. aliquot to 3, using N/2 H_2SO_4 and recording the amount of acid used.

Stability of Emulsion

Set aside a 200 cc. aliquot of the original emulsion, and the 200 cc. aliquot adjusted to pH 3 for 24 hours. Determine the % of oil still in the emulsion at the end of this time. Record the efficiency values of the two emulsions (i. e., the % total fatty matter in the emulsion at the end of 24 hrs. ÷ % fatty matter in the original emulsion.)

No. 51 POTASSIUM ACID TARTRATE

(Cream of Tartar)

$KHC_4H_4O_6$

Quantitative Estimation

Dissolve exactly 1 gram of the sample in hot water and titrate with N/10 sodium hydroxide using Phenolphthalein. Calculate as $KHC_4H_4O_6$. 1 cc. N/10 NaOH = 0.0188 gms. $KHC_4H_4O_6$.

Impurities

Weigh exactly 1 gram of the sample in a platinum crucible, and ignite at a dull red heat for 10 minutes. Boil the product with water, filter and wash the residue, if any. Titrate the filtrate with N/10 HCl, using Methyl Orange.

In a pure sample, the volume of acid required will exactly equal that of the alkali consumed in the first titration. An excess of alkali is calculated as $KHSO_4$. An excess of acid is calculated as $K_2C_4H_4O_6$.

1 cc. N/10 NaOH = 0.0136 gms. $KHSO_4$.

1 cc. N/10 HCl = 0.0113 gms. $K_2C_4H_4O_6$.

Average Analysis

Acid Potassium Tartrate as $KHC_4H_4O_6$	95.5%
Excess of Acidity as $KHSO_4$	4.0%

No. 52 RESORCINE

$C_6H_4(OH)_2$

Resorcine

Dissolve one to two grams of the sample in water and filter if necessary. Dilute to 500 cc. and treat 25 cc. of this solution with 100 cc. of N/10 bromine. To this add 50 cc. of water and 5 cc. of concentrated HCl. Shake in a stoppered vessel and let stand one minute. Add 10 cc. (more if needed) of freshly made KI (20% strength), and after a few moments add 200 cc. of water. Let stand five minutes and titrate the liberated iodine with N/10 sodium thiosulfate, using starch as an indicator toward the end of the titration. A blank is run on the same volume of N/10 bromine by the same method as above. The difference is calculated in terms of resorcine.

1 cc. N/10 $Na_2S_2O_3$ = 0.0183 gms. resorcine.

Average Analysis

Resorcine	95-98%

No. 53 SILK—WEIGHTED

Determination of Weighting

In order to have a representative sample, it is preferable to use a strip of cloth taken from selvage to selvage and weighing from 3 to 5 grams. Spread the sample loosely on a watch glass and dry for 1½ hours at 105 to 110° C. Transfer to a tared weighing bottle, cool in desiccator and weigh. The weight of the sample is designated weight A. The analysis is based on the weight of the dried sample.

Finishing Materials

Digest the sample in 90 to 100 times its weight of distilled water at 65 ± 1° C. for 20 minutes with occasional agitation. Decant the liquid and squeeze by hand. Rinse the sample by placing it in 40 to 50 times its weight of distilled water and heat with agitation to 65° C. Decant the rinse liquor and repeat the rinsing treatment twice more. Squeeze the sample by hand and rinse with two 30 cc. portions of warm alcohol, agitating it in each for about 2 minutes. Treat similarly with 2 portions of diethyl ether at room temperature, squeeze and air dry for about 10 minutes.

(Continued on page 517)

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

LOUIS A. OLNEY
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

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Volume XXI August 15, 1931 No. 17

GROWING OPTIMISM

SOME of the optimistic reports regarding improvement in general business conditions which have been appearing in the daily press for the last several weeks may be the result of artificial propaganda, as believed in some quarters. Yet there appears to be definite basis for the improvement in business sentiment, if not in actual business, which has taken place, and for the now fairly widespread opinion that the bottom of the depression has been seen. The start of the upturn, which it is admitted will probably be irregular in character, is confidently expected this fall, even in many ultra-conservative sections.

Current increased optimism, as far as general business is concerned, is apparently based largely on the upturn in security values, the rise which has taken place in many commodity markets, stimulating effects of the operations of the Reconstruction Finance Corporation, and so on. As far as textiles in particular are concerned, a striking advance has been made in the price of raw silk, rayon yarn business is better, and prices in this market are now conceded little chance of going lower. As of August 1st the Department of Agriculture has forecasted that the cotton crop this year will be 11,360,000 bales, 5,790,000 below last year and 3,352,000 below the average harvest for the last five years. This should have and has had a healthy effect on the price of raw cotton, as shown by the advance early last week in cotton futures prices.

Washington has been awaiting signs of increasing confidence on the part of the purchasing public, which, it is thought, will mark the turn of the depression, and Administration leaders foresee the advent of these indications in the near future. It has been asserted that one of the greatest hindrances to business has been lack of confidence which has held back the tremendous buying power of the general public. There has not been any lack of buying power but it has been held in check because of uncertainty and fear. The return of confidence will be an important movement in the direction of recovery.

Roy D. Chapin who recently assumed the office of Secretary of Commerce has called upon American business men to make every effort to strengthen all favorable factors which develop in order to make the turn in business conditions come as quickly and securely as possible. He also expressed his gratification at the now prevailing better tone in our industries and markets.

Perhaps the opinion of Henry H. Heimann, executive manager of the National Association of Credit Men, can best express the general feeling that is now in evidence. His statement, as appearing in his monthly review sent to members of the Association follows:

"The last half of July has shown a more decidedly optimistic spirit about the future than has been shown at any time during the last twelve months. This has developed as a consequence of a number of favorable indications in the business and financial world coupled with a feeling that the latest governmental proposals have succeeded in laying the foundation for better conditions without having gone to the extent of radicalism which was for a time feared.

"Among the favorable indications in recent weeks are strengthening in commodity prices, a more firm security market, the fact that the summer slump in business has not been as great as usual, reports from various sections of some increase in business activity and employment, a more favorable tendency in long-term money rates and last but not least, the improvement in live stock and pork prices.

"Improvement in the price of live stock is one which may be of great importance. Agriculture has been in a state of depression for so long a time that many have become almost entirely hopeless regarding any change. Farming is so basic among our industries that it is difficult to think of any decided and permanent improvement in conditions without there being some improvement in agricultural conditions.

"Aside from the benefits derived from increasing the purchasing power of the farmer, it is pertinent to call attention to the fact that increase in live stock prices should react favorably upon factories, particularly in the packing industry. The packers have been the victims of much Governmental interference and this has undoubtedly been one of the causes for the unprofitable operations of the packers. In the long run the farming communities have paid the price for this unprofitable operation.

"The two most important Government measures which have been enacted during the past thirty days have been the relief bill and the home loan bill. The hopefulness regarding both of these bills arises not entirely from the positive features of the bill, but also because there was such great fear that unwise and unbusinesslike features might be included in them. There was a generally favor-

able reaction toward the President's disapproval of the original relief bill. This bill was vicious inasmuch as it placed government directly in private business. It was uneconomic, did not square with sound credit principles and had it been made a law, would undoubtedly have been disastrous in its effects upon the credit of government and of industry.

"Everyone is in favor of doing everything possible to relieve our people of suffering and privation, but a bill such as was proposed would have had the contrary effect and would have retarded national recovery. It is unfortunate that so many of our legislators who are motivated by human sympathy and a desire to be of service to their fellow men, fail to realize that the only way they can be of constructive service is to keep legislation and relief measures within sound economic principles. It is the violation of these very principles that has placed us in our present position. To have violated them again would have been to discount our ability to draw a lesson from the past."

As general business conditions are improved so will the textile business improve. The present favorable sentiment may be only temporary but it is the opinion of many who are well qualified to advance such opinions that the bottom of this particular depression has been reached and we may look forward to better times soon. Of particular interest to us in the dyeing and finishing business will be the reflection apparent in our own industry as reflected from the general business improvement and particularly the whole of the textile industry.

Fashions For Mill Men

That the mill man needs a certain type of style information, despite the belief in certain quarters that he is too far removed from fashion influences to understand their value, is proved by the favorable reaction of mill executives and technicians to the newly developed style service featured in the July issue of "Silk." Given the latest word about consumer interest in silk or rayon fabrics, either in the form of piece goods or garments, the mill man realizes that he is better equipped to serve his part in the textile industry than by concentrating exclusively on the immediate problems of production. The important point is that fashion news must be presented in a way that will enable the mill man to extract useful and practicable information that may be applied in one or more phases of his work. That this can be done is indicated by comments made by many mill men in discussing their attitude to "Silk's" new "Trend of Fashion" department.

William J. Robertson

William J. Robertson, President of the Heller & Merz Corporation, died suddenly on July 23, 1932 in his sixtieth year.

He entered the employ of the Heller & Merz Company on March 18, 1895 and served that company faithfully and loyally until about 1922, when ill health forced his temporary retirement. In 1923 he returned, to assume management of sales. He continued in that position until the company was merged with The Calco Chemical Company, Inc. in 1930, and the present Heller & Merz Corporation was formed. In March 1932 he became president of the latter organization, a fitting reward for his long service.

To his host of friends in all parts of the country and to his associates he was always "Robby," loved for his loyalty and enthusiasm. His passing is a severe loss to the dyestuff industry.

He is survived by a son, William O. Robertson, and a daughter, Mrs. Helen O'Brien.

Dr. Louis J. Matos

The dye industry lost one of its most capable members when Dr. Louis J. Matos died at his home in East Orange, N. J. on July 9, 1932 at the age of 68. He was born on Sept. 30, 1864 in Philadelphia, Pa., and acquired an extensive education in chemistry with special emphasis on dyes and organic chemistry in general. He attended the University of Pennsylvania and received the degree of Doctor of Philosophy from the University of Giessen, Germany, in 1909.

In 1884 he entered the chemical laboratory of Dr. Charles P. Williams after which he entered the University of Pennsylvania as a special student in chemistry and mineralogy and acted as assistant to Professor T. W. Richards. He became chemist for the Dobson Carpet Mills in 1887 and held this position for several years. He was later chemist for and chief of Laboratories for Walter F. Sykes & Co., and in 1904 he became Chemist and Chemical engineer for the Casella Color Co. While employed by this company he became editor of "Dyestuffs," the house organ of that company and later of the present National Aniline & Chemical Co.

He is survived by a son Louis J. Matos, Jr., and a brother William W. Matos.

S. R. A. Dyestuffs

SRA Dyestuffs for Celanese are now available through the American Aniline Products, Inc., 50 Union Square, N. Y. C. and its branches.

The trade will welcome the fact that stocks will be carried in New York, Providence, Boston, Philadelphia, Chicago and Charlotte, North Carolina. Their laboratories have been trained for many years in the use of SRA Dyestuffs so that the consumers can now benefit from their experience.

Fashion shades are matched in advance so that it is possible for customers to obtain the formula, saving a great deal of time and laboratory work.

The SRA Dyestuffs need no introduction to the trade, since they were invented for the exclusive purpose of dyeing celanese and have long been pronounced as the complete line of dyestuffs for Celanese.

Reducing Dye House Costs With All Metal Dye Kettles

The material contained in this article is largely the result of cooperative experimental work carried out by a prominent Manufacturer of Dyeing and Finishing machinery and one of the leading dyestuff manufacturers. It furthermore reflects the experience of a number of the more progressive textile manufacturers who have the reputation of turning out excellent results from their dye houses. A long series of tests involving some two hundred or more of the *acid mordant dyes* showed that only six of these dyes were affected at all by nickel and only one seriously affected. As a result of this work it may be stated that nickel, chrome nickel, and stainless steel may be used in dye tub operation with equally excellent results.

NOT only in fulling, washing, stock and tenter drying and cloth carbonizing has equipment made tremendous strides during the past two years. There are now available new, all-metal piece dye kettles, that largely eliminate costly repairs and up-keep, and that enable dyers to process cloth uniformly and continuously at the highest possible hourly production compatible with quality standards.

These modern units, as built by one manufacturer, are constructed of pure nickel, hot rolled on steel, or of chrome nickel, depending upon dyeing requirements. With these up-to-date units a number of mills have greatly simplified and improved their piece dyeing operations and have materially reduced costs.

All dyeing operations have certain definite technical requirements and certain commercial requirements as follows:

1. Technical requirements.
   (a) To dye quickly and with true, full and uniform shade.
   (b) To effect this condition within a minimum of effort.
2. Commercial requirements.
   (a) To dye continuously with minimum loss of time between color changes.
   (b) To attain quality production at reduced cost per yard per dyestuff, labor, attendance and up-keep.
   (c) To operate continuously without shut-down and subsequent loss of labor, time and output.
   (d) To dye without risk of cost of seconds for re-dyes.

Meeting Requirements

To meet these requirements, various equipment is available. These units have essential differences. These differences eventually affect commercial requirements and plant profit. Thus, the history of the development of the nickel and chrome nickel all metal machines, plus the following points deserve close consideration. They will explain why all metal piece dye kettles will enable dyers to attain the highest commercial efficiency which is always translatable into dollars of profit.

The history of the development of the all metal kettle, as built by the manufacturer interviewed by this writer, and the reasons for the choice of nickel and chrome nickel are interesting. Beginning some four years before the announcement of the first all metal machine, engineers of the machinery manufacturer, working with outside chemists and metallurgists, began to experiment with porcelain, hard rubber, stainless steel, monel, nickel and chrome nickel as possible materials for dye tub fabrication. For various good reasons, some involving cost, and some involving non-workability of product, these engineers discarded the idea of using porcelain or hard rubber and confined themselves to an examination of the four metals—nickel, chrome nickel, monel metal and stainless steel alloys. It was found after a long series of tests, the manufacturer reports, that nickel, chrome nickel and stainless steel could be used equally as well insofar as trueness of shade was concerned in Dye Tub construction, but even then, there were essential differences. For example, it was found that nickel, hot rolled on steel, afforded tremendous advantages in construction, because, due to the type of metal, that is, nickel hot rolled on steel, it was possible to fabricate a kettle eliminating the need of heavy frames and numerous tie rods, braces and battens, such as are necessary to support the stainless steel sheet when formed into Dye Tubs. It was further found that it was impossible to weld stainless steel sheets without welding heat changing the intercrystalline structure of the alloy steel and seriously injuring, or completely destroying, the corrosion resisting properties of the stainless steel around the area of the weld. Welding methods produce localized precipitation of carbides which not only impair corrosion resisting properties but cause marked loss of tensile strength and embrittlement of the stainless sheets. For these reasons, then, the machine builder turned to self-sustaining pure nickel, hot rolled on steel and chrome nickel.

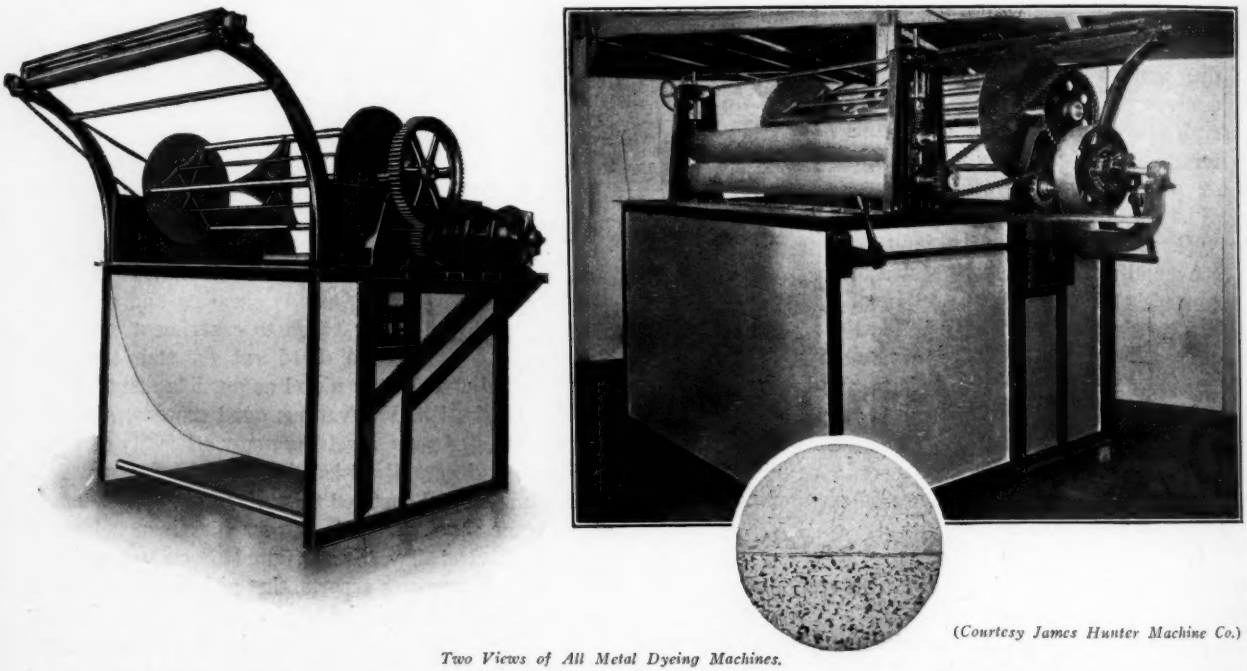
The main body of the nickel all metal kettle is, as we have said, fabricated of pure nickel, hot rolled on steel, or of chrome nickel. This type of construction is self-sustaining, corrosion proof, wear-proof and impervious to dyes. In addition, the front partition and the false bottom of the tub when supplied, are fabricated, also, of pure nickel or chrome nickel.

The nickel kettle is equipped throughout with roller bearings, heavy duty roller chain. The main reel, whip roll and delivery roll are made of pure nickel or chrome nickel. Splash boards and hand rods, combination rubber and nickel drain plugs, are likewise of pure nickel or chrome nickel. In some instances, hand wheel adjusted rubber squeeze rolls are furnished as an extra, depending upon the requirements.

of the reasons why they mark the end of wooden machines may be seen in a statement made to the writer a few weeks ago by two of the largest producers of woolens and worsteds in this country. Both of these principals said that after witnessing the advantages of the all metal kettle, no mill, in their opinion, could afford to install wooden machines in the future.

Nickel, Chrome Nickel and Stainless Alloys Equally Suitable for Dye Tub Operation So Far As Shade Is Concerned

Earlier in this article, we mentioned that the manufacturer's experiments with metals covering a wide range of investigations of metals in combination with dye liquors demonstrated that nickel, stainless steel and chrome nickel were in general equally suitable for dye tub construction,



(*Courtesy James Hunter Machine Co.*)

Two Views of All Metal Dyeing Machines.

The reader may ask exactly what are the advantages of this construction when measured against the initial cost. The answer is as simple as it is obvious. In the first place, all metal kettles eliminate completely the need of "boiling out" which in wooden kettles is a tremendous time consumer. In the metal kettle, a quick rinse is all that is required in going from the darkest to the lightest shade and back again. And that, in itself, is an economy and an impetus to production that needs no translation in dollars and cents for any dyer.

In the next place, as wood is eliminated completely, there can be no risk of colors bleeding out of the porous fibres to affect subsequent colors, thus there can be no risk of re-dyes or seconds. There is nothing to rot or leak, and nothing to replace. Thus, not only is up-keep cost eliminated, but there can be no idle machine and labor time to add to the cost of repairs.

The proof of the permanence of all metal kettles and so far as trueness, fullness and brightness of shade were concerned.

The reader then is cautioned against the generalization that nickel and the higher nickel alloys are not satisfactory for use in combinations with dye liquors. To demonstrate this, we quote below a letter received by an equipment builder from an independent textile chemist of the textile division of a leading technical college. This authority, after concluding a long series of tests on nickel, chrome nickel, stainless steel, nichrome, monel metal and glass, using among others, chrome acid dyes and acid dyes, writes:

"In making these dye tests, the dye solution for a given color was made up all in one batch to show uniformity, and measured identical quantities of this dye liquor were used. Care was taken to insure that the same weight of cloth was run in each beaker. The dyeings

(Continued on page 524)

Analytical Methods for a Textile Laboratory—Concluded

(Continued from page 512)

Drop the sample into a beaker of boiling water and let stand for 5 minutes, remove, squeeze, spread out on watch glass and dry for 1½ hours at 105 to 110° C. Place in tared weighing bottle, cool in desiccator, and weigh. This weight of the sample is called weight B. The material removed in this treatment is taken to be "finishing materials." The amount of "finishing materials" in per cent is $\frac{A-B}{A} \times 100$.

Total Weighting

The sample from which "finishing materials" have been removed is placed with 90 to 100 times its weight of hydrofluoric-hydrochloric acid reagent (see *a* below) in an 800 cc. tall-form Pyrex beaker, and heated uniformly to 55 ± 1° C. It is kept at this temperature for 20 minutes, agitating occasionally. The acid liquor is then poured off and the sample is treated with about 200 cc. distilled water at 55° C. for about 5 minutes with stirring. This treatment is then repeated with a fresh portion of distilled water, and the sample is removed and squeezed by hand.

The treatment outlined above, beginning with the addition of the acid reagent, is repeated. Then a similar treatment is given but using sodium carbonate (see *b* below) solution in place of the acid reagent. Then the acid treatment is repeated twice more, after which the sample is treated with alcohol, ether and boiling water as described in the procedure for the determination of "finishing materials." The sample is dried and weighed as previously described and this weight is called C. It represents the weight of silk fibroin and residual ash.

The ash is determined by igniting the sample after the above extraction process. Although the amount obtained as ash is generally negligible, the determination should be made when accurate results are required and as a check on the previous treatments. The treated sample is put in a tared crucible, and placed in an electric muffle furnace at about room temperature. The temperature of the furnace is regulated so that in 2 to 2½ hours, the furnace reaches a temperature of 750 to 800° C., and is held there for ½ hour. The combustion chamber should have a vent in the rear and near the top and the door should be raised about 4 millimeters at the front; this permits the free escape of gases and the admission of a gentle current of air by convection to effect complete combustion of the carbonaceous materials. The weight of the ash is called weight D.

The "total weighting" on the silk is taken to be all substances that are not silk-fibroin. The amount of "total weighting" in per cent is:—

$$\frac{A-C-D}{A} \times 100$$

The reagents called for above are:

a. Hydrofluoric-hydrochloric acid reagent: Contains two per cent by weight of hydrofluoric acid and two per cent by weight of hydrochloric acid in distilled water.

b. Sodium carbonate solution: Contains two per cent by weight of anhydrous sodium carbonate in distilled water.

No. 54 SOAP

Stock Solution

Weigh out 25 grams of the sample, dissolve in hot water and dilute to 250 cc.

Moisture

Pipette a 25 cc. aliquot from the stock solution into a moisture dish and evaporate to dryness. Dry in the oven at 100° C. for an hour and weigh.

Total Fatty Acids

Pipette 17.6 cc. alquots from the stock solution and place in Babcock Milk Bottles. Add 5 cc. of concentrated sulfuric acid, shake and centrifuge for five minutes. Add hot water to bring the meniscus to the top of the graduations and centrifuge for one minute more. Measure the length of the fat column with a pair of dividers. (For a ten per cent solution of soap each large division represents 10% of fatty acid.)

Hydrogen Ion Concentration

Dilute 10 cc. of the stock solution to 100 cc. and determine the pH colorimetrically. Nitro Yellow or Alizarine Yellow R are the most satisfactory indicators for this purpose.

Average Analysis of Neutral Boiled Soap

Moisture	25 to 30%
Total Fatty Acids	60 to 65%
pH of 1% Solution	10 to 10.4

No. 55 SODIUM ACETATE
$NaC_2H_3O_2.3H_2O$

Moisture

Weigh 1-2 gms. of the sample into a platinum crucible and heat in the oven at 110° C. to constant weight, with the cover on to prevent spattering. Calculate per cent moisture.

Strength Determination

With the same sample in which the moisture has already been determined, determine $NaC_2H_3O_2$ by igniting to constant weight over the Bunsen burner. This method depends on the quantitative conversion of $NaC_2H_3O_2$ into Na_2CO_3. Weigh as Na_2CO_3 and multiply by the factor 1.5604 to obtain $NaC_2H_3O_2$.

Qualitative Tests

Test qualitatively for chlorides, carbonates, and sulfates.

Average Analysis

Moisture	40.2%
$NaC_2H_3O_2$	59.6%

No. 56 SODIUM BICARBONATE
$NaHCO_3$

Strength Determination

A solution of 2 grams in 500 cc. water is made and 100 cc. aliquots are titrated with N/10 HCl. For the first half of the titration Phenolphthalein is used and then Methyl Orange is added and the titration completed. The first half of the titration accounts for ½ the carbonate, while the second half accounts for the remainder of the carbonate and all of the bicarbonate.

1 cc. N/10 HCl = 0.0053 gms. Na_2CO_3.
1 cc. N/10 HCl = 0.0084 gms. $NaHCO_3$.

Average Analysis

Bicarbonate as $NaHCO_3$	99.30%
Carbonate as Na_2CO_3	0.70%

No. 57 SODIUM BICHROMATE
$Na_2Cr_2O_7.2H_2O$

Quantitative Estimation

Weigh out 25 gms. of the sample and dissolve in exactly 500 cc. of water. Pipette out 100 cc. of this solution and dilute to a liter in a volumetric flask. Take 25 cc. of this solution, dilute largely, acidify with dilute sulfuric acid, add about a gram of potassium iodide, and titrate with N/10 sodium thiosulfate solution until the iodine color disappears, using starch at the end. Calculate as $Na_2Cr_2O_7.2H_2O$.

1 cc. N/10 $Na_2S_2O_3$ = 0.00497 gms. $Na_2Cr_2O_7.2H_2O$.

Qualitative Tests

Test for sulfate as usual.

Average Analysis

Sodium Bichromate as $Na_2Cr_2O_7.2H_2O$....99.72%

No. 58 SODIUM CARBONATE
(58% Alkali) (Mono Hydrate of Soda)
Na_2CO_3

Total Alkali

Weigh about 0.2 gms. of the sample into a beaker, dissolve in a fairly large amount of water, add 50 cc. of N/10 HCl, and then boil for at least 10 minutes to drive off all the carbon dioxide. Cool and titrate with N/10 NaOH, using Methyl Red as an indicator. Calculate as sodium oxide.

1 cc. N/10 HCl = 0.0031 gms. Na_2O.

Caustic Alkali

Weigh about 2.0 gms. of the sample into a 100 cc. volumetric flask, add 80 cc. of neutral 95% alcohol, and heat for ½ hour on the steam bath. Cool, make to the mark with alcohol, shake thoroughly, then allow precipitate to settle. Pipette out 50 cc. of the clear liquid and titrate with N/10 HCl, using Phenolphthalein as an indicator. Calculate as NaOH.

1 cc. N/10 HCl = 0.004 gms. NaOH.

Iron

Dissolve about 5 grams of the sample in water, add an excess of hydrochloric acid and about 5 cc. of dilute nitric acid, heat to boiling and then make alkaline with ammonia. If there is any iron present, it may be determined colorimetrically as in Hydrochloric Acid (No. 4).

Average Analysis

	Alkalinity as Na_2O
58% Alkali	57.9%
Mono Hydrate Soda	48.5%

No. 59 SODIUM CARBONATE
(Soda Ash)
Mixture of Na_2CO_3 and $NaHCO_3$

Strength Determination

A solution of 2 gms. in 500 cc. distilled water is made and 100 cc. aliquots are titrated with N/10 HCl. For the first half of the titration Phenolphthalein is used and then a couple of drops of Methyl Orange are added and the titration continued. The first titration corresponds to ½ of the carbonate present while the second represents the remainder of the carbonate and all of the bicarbonate. Calculate total alkalinity as Na_2O, also calculate Na_2CO_3 and $NaHCO_3$.

1 cc. N/10 HCl = 0.0031 gms. Na_2O.
1 cc. N/10 HCl = 0.0053 gms. Na_2CO_3.
1 cc. N/10 HCl = 0.0084 gms. $NaHCO_3$.

Average Analysis

Alkalinity as Na_2O	40.14%
Sodium Carbonate as Na_2CO_3	36.94%
Sodium Bicarbonate as $NaHCO_3$	47.58%

No. 60 SODIUM CHLORATE
$NaClO_3$

Quantitative Estimation

(Method of Zimmermann-Reinhardt)

Weigh out about 2 gms. of the sample, dissolve in water and dilute to exactly one liter. Pipette a 25 cc. aliquot of this solution into a 500 cc. flask, add 50 cc. of ferrous ammonium sulfate solution and 30 cc. of concentrated sulfuric acid. Place on the steam bath for 15 minutes. Cool, add 10 cc. of manganous sulfate solution and titrate with N/10 $KMnO_4$. Repeat the same procedure omitting the 25 cc. of sodium chlorate. The difference between the two titrations is calculated as $NaClO_3$.

1 cc. N/10 $KMnO_4$ = 0.001775 gms. $NaClO_3$.

Average Analysis

Sodium Chlorate as $NaClO_3$.....99.5%

No. 61 SODIUM CHLORIDE
(Common Salt)
NaCl

Chlorine

Weigh accurately about 0.2 gms. of the sample into a beaker and dissolve in about 100 cc. of water. Then add a few drops of potassium chromate and titrate with N/10 $AgNO_3$ until a faint red color appears. Calculate as NaCl.

1 cc.. N/10 $AgNO_3$ = 0.005845 gms. NaCl.

Qualitative Tests

Test for acidity, sulfates, lime and magnesium. Make a 20% solution in water and note the insoluble matter.

Average Analysis

Sodium Chlorate as NaCl.....99.4%

No. 62 SODIUM FERROCYANIDE
(Yellow Prussiate of Soda)
$Na_4Fe(CN)_6.12H_2O$

Quantitative Estimation

Weigh accurately about 5 gms. of the sample into a large casserole and dissolve in a large volume of water. Add 50 cc. of dilute sulfuric acid and titrate quickly with N/10 potassium permanganate. Calculate as iron and as sodium ferrocyanide.

1 cc. N/10 $KMnO_4$ = 0.005584 gms. Fe.
1 cc. N/10 $KMnO_4$ = 0.03041 gms. $Na_4Fe(CN)_6$.

Qualitative Tests

Test for sulfates as usual.

Average Analysis

Iron as Fe..... 11.75%
Sodium Ferrocyanide as $Na_4Fe(CN)_6$. 63.93%

No. 63 SODIUM HYDROSULFITE
(Hydrosulfite) (Lykopon)
$Na_2S_2O_4$

Strength Determination

About 0.4 grams of the sample are accurately weighed out in a carefully dried stoppered weighing bottle. A silver solution is prepared by dissolving 1 gram of silver nitrate in 10 cc. of distilled water and adding 15 cc. of 20% ammonia. This solution is poured on to the solid hydrosulfite, and the reacting substances are well mixed together with a thin glass rod. After about 3 hours the gray precipitate of silver is filtered off, washed thoroughly with dilute ammonium nitrate solution until free of silver nitrate, dried, ignited and weighed in the usual way. The silver may also be dissolved in dilute nitric acid and titrated with N/10 potassium thiocyanate.

1 cc. N/10 KSCN = 0.0108 gms. of silver.

216 parts of silver are equivalent to 174 parts of pure anhydrous sodium hydrosulfite ($Na_2S_2O_4$).

No. 64 SODIUM HYDROXIDE
(Caustic Soda)
NaOH

Strength Determination

10 grams of the sample are dissolved in 500 cc. of water. 10 cc. aliquots are titrated cold with N/10 HCl. For the first half of the titration, Phenolphthalein is used, then a few drops of Methyl Orange are added and the titration continued. The first titration represents all the caustic (NaOH) and ½ of the carbonate (Na_2CO_3) present, while the second gives the remainder of the carbonate. Calculate total alkalinity as Na_2O, also calculate NaOH and Na_2CO_3.

1 cc. N/10 HCl = 0.0031 gms. Na_2O.
1 cc. N/10 HCl = 0.0040 gms. NaOH.
1 cc. N/10 HCl = 0.0053 gms. Na_2CO_3.

Chlorides and Sulfates

Determine as under Sodium Chloride (No. 61) and Sodium Sulfate (No. 72).

Average Analysis

Total Alkalinity as Na_2O..... 75.22%
Sodium Hydroxide as NaOH..... 94.98%
Sodium Carbonate as Na_2CO_3..... 2.09%
Sodium Chloride as NaCl....Not over 1.50%
Sodium Sulfate as Na_2SO_4..Not over 1.25%

No. 65 SODIUM HYPOCHLORITE
NaOCl

Specific Gravity

Determine with the hydrometer at 15° C.

Free Alkali and Available Chlorine

Pipette 25 cc. of the sample into a liter volumetric flask containing about 500 cc. of water, and then dilute to the mark. Pipette a 50 cc. aliquot into a 300 cc.

Erlenmeyer flask, add about 150 cc. of water and an excess of potassium iodide. Then run in exactly 20 cc. of N/2 HCl. Titrate with N/10 $Na_2S_2O_3$ until the yellow color of the liberated iodine is discharged, then add Methyl Orange and titrate the excess of HCl with N/2 NaOH. Convert the tirations to the basis of N/10 solutions. From the total amount of N/10 HCl (i.e., 100 cc.) subtract the cc. of N/10 $Na_2S_2O_3$ and then the cc. of N/10 NaOH. The remainder is the amount of N/10 HCl. required to neutralize the free alkalinity. Calculate as NaOH.

1 cc. N/10 HCl = 0.0040 gms. NaOH.

The available chlorine is calculated as Cl from the amount of N/10 $Na_2S_2O_3$ required in the above titration.

1 cc. N/10 $Na_2S_2O_3$ = 0.003546 gms. Cl.

No. 66 SODIUM NITRITE
$NaNO_2$

Strength Estimation

Weigh from 0.2 to 0.3 gms. into a beaker and dissolve in a large volume of water. Acidify with dilute sulfuric acid and titrate with N/10 potassium permanganate until, after the addition of 0.5 cc. the color persists for at least two minutes. Calculate as $NaNO_2$.

1 cc. N/10 $KMnO_4$ = 0.00345 gms. $NaNO_2$.

Sulfates and Chlorides

Test for both of these in the usual manner.

Average Analysis

Sodium Nitrate as $NaNO_2$.....93.0%

No. 67 SODIUM PEROXIDE
Na_2O_2

Strength Determination

1.5 to 2.0 grams of sodium peroxide are placed in a weighing bottle which is tightly closed with a rubber stopper. The difference between the weight when full and the weight after the sample is removed gives the full weight of the sample used. Exactly 1000 cc. of a 2.5% solution (14 cc. of concentrated acid to 1 liter) of sulfuric acid are placed in a beaker and means for rapidly and continuously stirring the solution are provided. When the solution is in rapid circulation the peroxide is sprinkled from the vial over the surface of the solution, a little at a time, avoiding the addition of amounts which would cling together when first added to the solution. After all the peroxide has been added, the stirring is continued until no more solid can be seen in the solution. 60 cc. of the peroxide solution are withdrawn and titrated with N/10 potassium permanganate. Calculate for Na_2O_2 and for available oxygen.

1 cc. N/10 $KMnO_4$ = 0.0039 gms. Na_2O_2.

1 cc. N/10 $KMnO_4$ = 0.0008 gms. oxygen.

Remarks

It is very important that the peroxide be exposed to the air as little as possible. The chief source of difficulty lies in the decomposition of the peroxide when first added to the acid solution. It is also important that the peroxide be scattered as it is being added and that the solution be well stirred during the operation.

Total Alkali

Dissolve 0.2 grams of the sample in water, add an excess of N/10 HCl and titrate back with N/10 sodium hydroxide using Phenolphthalein as an indicator. Calculate as sodium oxide (Na_2O).

1 cc. N/10 HCl = 0.0031 gms. Na_2O.

Average Analysis

Sodium Peroxide as Na_2O_2	90-92%
Sodium Oxide as Na_2O	80%
Actual Available Oxygen	16-19%

No. 68 SODIUM PHOSPHATE—BASIC
(Trisodium Phosphate)
$Na_3PO_4.12H_2O$

Quantitative Estimation

Proceed as described for Normal Sodium Phosphate (No. 69). Weigh as $Mg_2P_2O_7$ and calculate as P_2O_5 or Na_3PO_4. Multiply $Mg_2P_2O_7$ by the factor 0.6376 to obtain P_2O_5, or by the factor 1.473 to obtain Na_3PO_4.

Alkalinity

Dissolve about 1 gm. of the sample in 100 cc. of water and titrate with N/10 HCl using Phenolphthalein as an indicator. Calculate as Na_2O.

1 cc. N/10 HCl = 0.0031 gms. Na_2O.

Insoluble Matter

If in the solution which is prepared for the quantitative estimation there is some insoluble matter, it should be filtered off, washed, ignited and weighed.

Hydrogen Ion Concentration

Determine the pH of a 0.1% solution of the sample colorimetrically, using Alizarine Yellow R as the indicator.

Average Analysis

Phosphoric Anhydride as P_2O_5	18.92%
Trisodium Phosphate as Na_3PO_4	43.70%
Alkalinity as Na_2O	9.05%
Insoluble Matter	Not over 2.50%
pH of a 0.1% solution	About 11.0

No. 69 SODIUM PHOSPHATE—NORMAL
(Phosphate of Soda) (Disodium Phosphate)
$Na_2HPO_4.12H_2O$

Quantitative Estimation

Weigh out 2 grams of the sample and dissolve in 100 cc. of water, then add 20 cc. of ammonium chloride solution and slowly pour in magnesium mixture with constant stirring, 10 cc. of this for every 0.5 gram of sample used. Finally add 40 cc. of concentrated ammonium hydroxide slowly, continuing the stirring. Let stand over night and filter on a gooch, wash with water containing 1/3 its volume of dilute ammonium hydroxide. Ignite and weigh $Mg_2P_2O_7$. Calculate as P_2O_5. Multiply $Mg_2P_2O_7$ by the factor 0.6376 to obtain P_2O_5.

Alkalinity

Determine the pH of a 1% solution of the sample colorimetrically, using Thymol Blue as the indicator.

Qualitative Tests

Test in the usual manner for sulfates, carbonates, and chlorides. If there are any present in noticeable amounts, they may be determined quantitatively.

Average Analysis

Phosphoric Anhydride as P_2O_5..... 19.90%
pH of a 1% Solution.....About 9.0

No. 70 SODIUM POTASSIUM TARTRATE

(Rochelle Salts)

$NaKC_4H_4O_6.4H_2O$

Strength Determination

Weigh accurately about 0.4 gms. of the sample into a platinum crucible and ignite at a low red heat. Dissolve the ash in hot water transfer to a beaker, heat to boiling, and then titrate with N/10 HCl using Methyl Orange as an indicator. Calculate as $NaKC_4H_4O_6$.

1 cc. N/10 HCl = 0.01051 gms. $NaKC_4H_4O_6$.

Average Analysis

Actual Salt as $NaKC_4H_4O_6$, 74.81%.

No. 71 SODIUM SILICATE

(Silicate of Soda) (Water Glass)

$Na_2O.(SiO_2)_x$

Specific Gravity

Determine with the hydrometer at 15° C.

Sodium Oxide

Weigh ½ to 2 grams of the liquid in a covered vessel such as a porcelain crucible covered with a watch glass. The sample is dissolved in about 80 to 100 cc. of water, heating if necessary, then titrated with N/10 HCl, using Methyl Orange as an indicator. Calculate as Na_2O.

1 cc. N/10 HCl = 0.0031 gms. Na_2O.

Silica

To the solution from above add an excess of concentrated hydrochloric acid. Evaporate down to dryness three times without filtration between, moistening the residue each time with concentrated hydrochloric acid and then adding about 50 cc. of water. After the third evaporation, add concentrated acid and water as usual, then filter, ignite the precipitate and weight as SiO_2.

Stability Test

Mix 7 cc. of the sample with 50 cc. of a clear 5% solution of anhydrous disodium phosphate. Heat for about 7 minutes or until boiling just begins, then allow to cool for 10 minutes. The formation of a flocculent precipitate condemns the sample.

Average Analysis of Silicate of Soda for Silk Weighting

Specific Gravity 1.4078
Sodium Oxide as Na_2O...Approximately 10%
Silica as SiO_2.....Approximately 25%

No. 72 SODIUM SULFATE

(Anhydrous Sodium Sulfate) (Glauber's Salt)

Na_2SO_4 or $Na_2SO_4.10H_2O$

Moisture

Weigh out from 1 to 2 gms. of the sample and dry to constant weight in the oven at 100° C.

Sodium Sulfate

Dissolve the dried material from above in about 300 cc. of water. Add 1 cc. of concentrated hydrochloric acid and heat to boiling. Meanwhile 10 cc. of saturated barium chloride solution is diluted to 100 cc. and heated to boiling. Precipitate the sulfate by adding the hot barium chloride to the hot sulfate solution. Stir well and let stand at least two hours on the steam bath covered with a watch glass. Filter through a gooch crucible, wash with hot water, ignite and weigh as $BaSO_4$. Multiply by the factor 0.608 to obtain Na_2SO_4.

Qualitative Tests

Test as usual for iron, chlorides and carbonates. If the presence of more than a trace is indicated, determine quantitatively as noted below.

Iron

Dissolve 1 gm. of the sample in a casserole in about 30 cc. of distilled water. Add 10 cc. concentrated hydrochloric acid and heat to boiling. Cool and transfer to a Nessler tube, filtering if necessary. Then proceed as described under Hydrochloric Acid (No. 4).

Chlorides

Weigh out 5 gms. of the sample and dissolve in a 6-inch evaporating dish with 100 cc. of distilled water. Add 1 cc. of concentrated nitric acid, stir, then add a slight excess of sodium bicarbonate and titrate with N/10 silver nitrate using potassium chromate as an indicator. Calculate as NaCl.

1 cc. N/10 $AgNO_3$ = 0.005845 gms. NaCl.

Carbonates

Dissolve a 10-gm. sample in 100 cc. of distilled water and titrate with N/10 HCl using Methyl Orange as an indicator. Calculate as Na_2CO_3.

1 cc. N/10 HCl = 0.0053 gms. Na_2CO_3.

Average Analysis

	Sodium Sulfate as Na_2SO_4
Glauber's Salt	44.5%
Anhydrous Sodium Sulfate	99.3%

No. 73 SODIUM SULFIDE

(Fused or Crystalline)

Na_2S or $Na_2S.9H_2O$

Quantitative Estimation

Weigh out about 5 gms. of the sample and dissolve in 250 cc. of water. If the sodium sulfide is anhydrous, use 25 cc. aliquots for titration; if crystallized with nine molecules of water, use 50 cc. aliquots. Make to a volume of about 200 cc., add Phenolphthalein and titrate

with N/10 HCl. The free alkali may be calculated from this data. When the solution is neutral, continue the titration with N/5 zinc sulfate solution. A blotting paper soaked in a saturated solution of cadmium sulfate is used to determine the end point. As long as any alkaline sulfide remains, a drop of the liquid will show yellow on the blotting paper. Calculate as sodium sulfide (Na_2S).

1 cc. zinc sulfate N/5 = 0.007806 gms. Na_2S.

Average Analysis

	Sodium Sulfide as Na_2S
Fused Sodium Sulfide	58.2%
Crystalline Sodium Sulfide	19.4%

No. 74

SODIUM SULFOXYLATE—FORMALDEHYDE
(Formopon)
$NaHSO_2.CH_2O.2H_2O$

Strength Determination

Two grams of the sample are dissolved in water and diluted to 500 cc.

A. 20 cc. aliquots are titrated with N/10 iodine, without the addition of $NaHCO_3$. There is no need to add starch solution as the end reaction shows sharply with the yellow color of the iodine.

B. 20 cc. aliquots are taken and 5 cc. of formaldehyde solution (1:9) are added. The solutions are then titrated with N/10 iodine without $NaHCO_3$.

C. To the solutions from A after the titration without sodium bicarbonate, an excess of the sodium bicarbonate is now added and the titration continued.

Calculations

1. Sodium Bisulfite
   Subtract the B titration from the A titration and calculate as $NaHSO_3$.
   1 cc. N/10 Iodine = 0.0052 gms. $NaHSO_3$.
2. Sodium Bisulfite-Formaldehyde
   Calculate the C titration as $NaHSO_3.CH_2O.2H_2O$.
   1 cc. N/10 Iodine = 0.0085 gms. $NaHSO_3.CH_2.O2H_2O$.
3. Sodium Sulfoxylate-Formaldehyde
   Calculate the B titration as $NaHSO_2.CH_2O.2H_2O$.
   1 cc. N/10 Iodine = 0.00385 gms. $NaHSO_2.CH_2O.2H_2O$.

No. 75

STANNIC CHLORIDE
(Tin Tetrachloride)
$SnCl_4$

NOTE:— Tin tetrachloride is usually sold in the anhydrous form which gives off copious white fumes as soon as it is exposed to the air. It is usually conveyed by means of a syphon directly from the drum into a tank of water in order to form a stock solution. The analysis is usually made on this stock solution.

Specific Gravity

Determine with the hydrometer at 20° C.

Tin

Weigh accurately about 0.5 gms. of the sample in a glass stoppered weighing bottle. Transfer with a little cold water to a 400 cc. beaker. Precipitate tin hydroxide by adding about 200 cc. of hot water and digesting on the steam bath for a short time, keeping the beaker covered with a watch glass. Filter carefully through ashless paper and wash thoroughly with hot water to remove all HCl. Combine and save the filtrate and washings. Transfer the precipitate and paper to a clean weighed porcelain crucible. Dry at 100° C. in the oven, then ignite, carefully at first, and finally at the full heat of a Fisher burner. Weigh as SnO_2. Multiply SnO_2 by the factor 0.788 to obtain Sn.

Total Hydrochloric Acid

Titrate the filtrate and washings from above with N/10 NaOH using Methyl Red as an indicator. Calculate as HCl.

1 cc. N/10 NaOH = 0.003647 gms. HCl.

Free Hydrochloric Acid

Calculate the amount of HCl required to combine with the SnO_2 as determined above. $SnO_2 \times 0.9678$ = HCl. The difference between the total HCl and the combined HCl gives the free HCl.

Average Analysis

Anhydrous Tetrachloride of Tin	
Specific Gravity	2.26
Tin	45.4%
Typical Stock Solution	
Specific Gravity	1.64
Tin	25.0%
Free HCl	1.5%

No. 76

STANNOUS CHLORIDE
(Tin Crystals)
$SnCl_2.2H_2O$

Tin

Weigh 0.6 to 0.8 gms. of the sample into a beaker and dissolve in 50 cc. of dilute hydrochloric acid. To the solution add slowly, with stiring, a 10% solution of ferric chloride until there is an excess present (as shown by the yellow color). Then dilute and titrate with N/10 potassium permanganate. Calculate as Sn.

1 cc. N/10 $KMnO_4$ = 0.005935 gms. Sn.

Qualitative Tests

Take a small quantity of the sample, dissolve as much as possible in water and test with litmus. Then add enough dilute hydrochloric acid to make a clear solution. Pour in about 10 cc. of barium chloride solution and note whether any turbidity appears on standing.

Average Analysis

Tin as Sn, 51.5%.

No. 77

TITANOUS SULFATE
$Ti_2(SO_4)_3$

Moisture

Weigh accurately about 5 gms. of the sample into a porcelain crucible and dry in the oven at 100° C.

Reducing Power

Weigh accurately about 50 gms. of the sample in a glass stoppered weighing bottle and dilute to one liter with distilled water. A 25 cc. aliquot of this solution is added to about 50 cc. of ferric alum solution containing 8 to 10 cc. of manganous sulfate solution. The resulting ferrous iron is titrated at once with N/10 potassium permanganate. Calculate as TiO_2.

1 cc. N/10 $KMnO_4$ = 0.008 gms. TiO_2.

No. 78 TURPENTINE

Fractional Distillation

Into a distilling flask of about 250 cc. capacity pour 100 cc. of the sample to be tested. Insert a delicate thermometer so that its bulb reaches to within ⅜ in. of the bottom of the flask. The outlet from the flask should lead into a condenser about 2 ft. long, through which cold water is freely circulating. The flask should be supported by an asbestos board in which a hole has been cut so that the Bunsen flame may play directly on the glass. The distillate should be caught in a 100 cc. graduated cylinder. The successive temperatures at which the first drop, 5 cc., 10 cc., 20 cc., 30 cc., etc., pass over are carefully noted and the distillation is prolonged until 90 cc. have entered the graduate.

Residue

Pipette 100 cc. of the sample into a weighed porcelain evaporating dish and evaporate nearly to dryness on the steam bath, then place in an oven and heat at 100° C. for two hours. Cool and weigh.

Average Analysis of a Good Grade of Turpentine

Specific Gravity	0.870
Residue	not over 1.2%
Fractional Distillation	90% by volume distills between 160 and 166° C.

No. 79 WATER

Technical Examination

1. *Insoluble Matter*

Take 1000 cc. of the sample, add 25 cc. of dilute hydrochloric acid and evaporate to dryness, avoiding all spattering. Dissolve the residue in a small amount of dilute hydrochloric acid (not over 25 cc.), heat nearly to boiling, then filter and wash with warm water. The precipitate is dried, ignited in a platinum crucible and weighed. Calculate to parts per million of water.

2. *Iron and Alumina*

To the filtrate from (1) add a few drops of strong nitric acid and boil for a couple of minutes, then slowly pour in dilute ammonium hydroxide until the solution is slightly ammoniacal. Avoid using a large excess. Heat to boiling, wash, dry, ignite in a platinum crucible and weigh as Fe_2O_3 plus Al_2O_3. Calculate to parts per million of water.

3. *Colorimetric Determination of Iron*

Dissolve the solid material left in the platinum crucible from (2) in nitro-hydrochloric acid, transferring to a beaker. Evaporate practically to dryness to remove the excess of acid, then take up with water and make to 100 cc. Now into two colorless glass cylinders marked at 100 cc. put 5 cc. of dilute nitric acid and 10 cc. of the potassium thiocyanate solution. Add 20 cc. of the above iron solution to one and then make both up to the mark with distilled water. Run the standard iron solution into the colorless cylinder until its color exactly duplicates the other one.

4. *Calcium*

To the filtrate from (2) add 25 cc. of ammonium chloride, 25 cc. of ammonium hydroxide (dilute) and heat to boiling. Then add sufficient ammonium oxalate to precipitate all the calcium, keep the solution hot for 30 minutes, then filter and wash with warm water. Wash the precipitate into a beaker, add 50 cc. of dilute sulfuric acid and titrate with N/50 $KMnO_4$. Calculate to parts per million of CaO.

1 cc. N/50 $KMnO_4$ = 0.00056 gms. CaO.

5. *Magnesium*

Evaporate the filtrate from the calcium to about half volume, make sure that there is an excess of ammonia present, then add 15 cc. of sodium phosphate. Stir vigorously then let stand for at least 24 hours. Filter on a gooch, ignite at low red heat, and weigh $Mg_2P_2O_7$. Calculate to parts per million of MgO. Multiply $Mg_2P_2O_7$ by the factor 0.3621 to obtain MgO.

6. *Total Hardness*

Titrate 50 cc. of the sample with N/250 soap solution, using a glass stoppered bottle and shaking vigorously after each addition. The end point is reached if, after shaking well, the foam is permanent for five minutes and covers the entire surface of the liquid with the bottle laid on its side. Calculate as parts per million of hardness.

1 cc. N/250 soap = 4 parts per million of hardness ($CaCO_3$).

7. *Alkalinity*

100 cc. of the sample is put in a 250 cc. glass stoppered bottle, 5 cc. of chloroform and 5 cc. of Erythrosine solution (0.5 gms. to 1 liter) added, and N/50 sulfuric acid run in slowly, shaking vigorously after the addition of every few drops. The end point is shown by the disappearance of the color. Calculate as $CaCO_3$.

1 cc. N/50 H_2SO_4 = 10 parts per million of alkalinity ($CaCO_3$).

No. 80 ZINC OXIDE

Strength Determination

Weigh accurately about one gram of the sample. Cover with water and dissolve in dilute hydrochloric acid. Add 20 cc. of ammonium chloride solution, boil, and then add enough disodium phosphate solution to complete the

precipitation. (50 cc.) Make alkaline with dilute ammonia, which, when in excess will dissolve the precipitate. Then acidify slightly with dilute acetic acid. Let the precipitate settle on steam bath until crystalline. Filter on a prepared gooch, wash with hot water and ignite the zinc ammonium phosphate to zinc pyrophosphate, $Zn_2P_2O_7$. Calculate the percentage of zinc or zinc oxide. Multiply $Zn_2P_2O_7$ by the factor 0.429 to obtain Zn, or by the factor 0.534 to obtain ZnO.

Average Analysis

Zn	79.0%
ZnO	98-99%

Reducing Dye House Costs With All-Metal Steel Kettles

(Continued from page 516)

were made at the boil, and the liquid levels were maintained constant in the respective beakers throughout the operation by the addition of hot distilled water for makeup.

"From the results of these tests, there is no available evidence that any one of the three metals (nickel, chrome nickel and stainless steel), is more satisfactory than the other, with all factors considered, for dye tub construction."

Furthermore, a list of over 200 mordant acid dyes (top chrome dyes) recently studied by a leading dyestuff manufacturer showed that less than six dyes were at all affected by nickel and of these only one was seriously affected. Where this one type of dyestuff is encountered, it is singularly easy to solve the problem by the use of chrome nickel instead of nickel in the all metal kettle.

Thus, the reader will readily see that, if he is shown samples of dyeings made in nickel beakers chosen from the one or two colors unfavorable to nickel, he gets a completely distorted picture and one that is not true. In addition, the experience of the interviewed machine builder shows that a selection of dyestuffs from another class less favorable to the stainless metals, or a change in laboratory conditions would result in an equally distorted picture unfavorable to the stainless alloys.

The picture is true only when it is stated that any one of the three metals (nickel, chrome nickel and stainless steel) may be used in dye tub operation with equally excellent results. And that irrespective of the three metals used, a dyer will always be able to duplicate the shade of a previous run dyed in the same kettle. Practically, that is of far more importance in actual dye house operation than the ability to duplicate in a metal beaker in a laboratory a shade obtained in a glass beaker.

As further demonstration of the suitability of nickel and the higher nickel alloys for dye kettle construction, it should be noted that one of the largest dyestuff manufacturers in America uses nickel-clad steel for his dyestuff manufacturing equipment after testing all metals.

What possible element of advantage there is lies with the nickel and chrome nickel kettle, due to its lower cost to fabricate, and as we have shown above, its self sustaining strength which eliminates the need of cumbersome and expensive frames, tie rods, supports, battens, etc.

Recommended Commercial Standard for Standard Grading of Sulphonated (Sulphated) Oils, Saponifiable Types

Adopted by the General conference of manufacturers, distributors, and users held in New York, N. Y., on June 30th, 1932.

Purpose

1. This commercial standard is established to provide a basis of understanding for the guidance of producers, distributors and users, in order to eliminate confusion resulting from a diversity of opinion relative to the grading of sulphonated (sulphated) oil.

Scope

2. This specification covers the method of grading sulphonated (sulphated oils, saponifiable types, which split off their organically combined SO_3 upon boiling with mineral acids, and includes definition, nomenclature and methods of analysis.)

Definition

3. For the purposes of these specifications, the term "sulphonated oil" shall designate the product of interaction between a saponifiable oil or fat or its fatty acids, or a mixture of saponifiable oils or fats or their fatty acids, and sulphuric acid or similar sulphonating agent, the reaction to take place under such conditions that some or all of the oil is converted into a sulphate. With the exception of water and alkali, it shall contain no other admixture.

Nomenclature

4. A sulphonated oil of any particular designation shall contain no other oil or fat except the kind designated. For example, an oil sold as sulphonated castor oil shall be manufactured from no other oil or fat except castor oil.

Strength

5. The strength or concentration of a sulphonated oil shall be expressed as the sum of the percentage by weight of the following active ingredients as determined under "Methods of Analysis":

(a)—Total fatty matter;

(b)—Total alkali bound as soap, calculated as (Na—1);

(c)—Neutralized organically combined SO_3, calculated as (SO_3Na—1).

Methods of Analysis

6. (a)—*Total Fatty Matter*: Weigh 5 to 10 grams of the oil into a 500 ml Erlenmeyer flask and add 25 ml of water and 30 ml of concentrated hydrochloric acid. Boil while shaking for about 15 minutes, or until the oil and water layers become clear; cool, extract the fat

three times with 50 ml portions of ethyl ether, and wash the combined ether layers three times with 10 ml portions of water, or until the wash water is neutral to methyl orange. Evaporate the ether and dry the residue to constant weight at 105°C. The weight of the dry residue expressed as a percentage of the weight of the oil taken for analysis is the total fatty matter in per cent*.

(b)—*Total Alkali Bound As Soap Calculated As (Na—1)*: Weigh 10 grams of the oil into a 250 ml flask, dissolve in 150 ml of water, warming to obtain solution, if necessary. Add 30 grams of granulated sodium chloride, 25 ml of ether, and 5 ml of methyl orange indicator (0.1 per cent solution) and titrate with approximately 0.5 sulphuric acid. Convert the amount of acid required to its equivalent in milligrams of KOH per gram of sample. Let this value equal A.

For the value to be added to other active ingredients, calculate as follows:

$$A = \text{milligrams of KOH per gram of sample} = \frac{\text{ml } H_2SO_4 \text{ required} \times \text{titer of the acid used}}{\text{weight of the sample}}$$

Note: The "titer" of a solution in this standard is the normality equivalent of the solution expressed as the number of milligrams of KOH per milliliter of the solution.

$$\% \text{ combined sodium } A\ (Na—1^*) = A \times \frac{23—1}{56.1} = A \times 0.0392$$

Example:

Let 15.9 = number of ml of sulphuric acid solution required and 28.1 = titer of this solution.

Then

$$\% \text{ combined sodium} = \frac{15.9 \times 28.1 \times 0.0392}{10} = 1.75\%$$

Note: It is to be noted that when the sulphonated oil contains free alkali, special methods of analysis are required.

(c)—*Neutralized Organically Combined SO_3 Calculated As (SO_3Na1)*: (1) Combined SO_3: Weigh 8 grams of the oil into a 300 ml flask and boil for one hour under a reflux condenser with 25 ml of normal sulphuric acid, using glass beads to prevent bumping. Shake frequently. Rinse the condenser, disconnect the flask and cool. Add about 20 ml of ether, 100 ml of water, 30 grams of granulated sodium chloride and 5 ml of methyl orange indicator, 0.1% solution. Titrate with 0.5 N sodium hydroxide. Frequently stopper and shake the flask during the titration. Deduct the equivalent of the added H_2SO_4 from the quantity of sodium hydroxide required for the titration and calculate the difference to milligrams of KOH per gram of sample. Let this value equal F.

$$F = \frac{\text{ml NaOH required} \times \text{titer NaOH} — 25 \times \text{titer } H_2SO_4}{\text{weight of sample}}$$

Then the percentage of combined SO_3 equals the sum of F plus A, obtained under "Total Alkali," multiplied by 8 and divided by 56.1 or per cent combined $SO_3 = (F + A)\ 8 = 0.1426\ (F + A)$.

56.1

*See note, column one.

Example:

Let 45.5=number of ml of NaOH required.
27.6=the titer of this NaOH solution.
56.3=the titer of the sulphuric acid solution used.
For A see calculations under "Total Alkali."

Then

$$\% \text{ combined } SO_3 = \frac{0.1426 \times (45.5 \times 27.6) — (25.0 \times 56.3)}{8} + \frac{15.9 \times 28.1}{10} = 3.67\%$$

(a)—*Neutralized Combined SO_3 Calculated As (SO_3Na—1)*: The percentage of neutralized combined SO_3, calculated as (SO_3Na—1) equals

$$SO_3Na—1^* \times \frac{\%\text{ combined } SO_3}{SO_3} = \frac{102 \times \%\text{ combined}}{80}$$

$SO_3 = 1.275 \times$ combined SO_3.

Example:

Neutralized Combined SO_3 equals
$1.275 \times 3.67 = 4.68\%$

*See note, column one.

NOTE: The "Total fatty matter" obtained in section 6 (a) is actually too high by one hydrogen atom for each "sodium" found in 6 (b) and for each "SO_3Na" group found in 6 (c) (2). Although the error introduced is small, the atomic weight of hydrogen (1) is introduced into the calculations in 6 (b) and 6 (c) (2), in order to have the sum of the active ingredients of the oil, Section 5, correct.

Display Features 58 Pine Derivatives

The diversity of products which may be obtained from the pine stump by the steam and solvent process has been strikingly called to attention by the Hercules Powder Company Experiment Station at Wilmington, Del.

A display consisting of a complete set of naval stores samples has been arranged by the Experiment Station staff, and was recently exhibited at the Convention of the Georgia Forestry Association.

Fifty-eight samples are shown in the display, all derivatives of the pine stump wood. Some of the samples are standard pine products; others are new and in process of development on a semi-commercial scale; while a few represent purely laboratory products.

Technical Notes from Foreign Sources

A New Illuminant for Color-Work

Dr. A. Sarony—Kunst-Seide 13,104 (1931)—A new "daylight" lamp, with additional qualifications.

Daylight lamps are almost always merely incandescent bulbs, usually with a tungsten filament, the light from which is filtered through interposed colored glass screens before it reaches the material to be examined. Mercury-vapor arc-lamps of various forms are in wide use as "ultra-lamps"—so-called because of the richness of the emitted light in the ultraviolet rays; those with glass containers not very effective, those with such a glass as "Uviol" glass more effective, and those with a quartz bulb or tube (the most common kind) most effective. As to the lamps with corrective filters, the quality of the radiation alters with variations in the voltage of the current, so impossible to avoid; and much of the light is sometimes lost in its passage through the filters.

Work done upon the spectra of gases excited by high-tension discharges have indicated luminous carbon dioxide as most suitable for such an illuminant. The apparatus particularly referred to is one now on the market as the "Agalindus-Tageslichtapparate," and consists of a transformer for converting ordinary alternating current into a high-tension alternating one, whose continuous discharge through a tube filled with carbon dioxide under low pressure (a few millimeters of mercury) produces a radiation which throughout the spectrum is the most similar to daylight of any illuminant yet made available. It is claimed that the apparatus, when used in color-matching, makes possible the differentiation of colors so similar that the difference between them is unnoticeable in ordinary daylight, even to a skilled eye, without any of that harsh distinctiveness, unreal in its impression, which

The carbon dioxide in the tube is gradually decomposed by the high-voltage discharge passing through it, and has to be renewed regularly—the tube has to be "freshened up." This was attempted at first by means of inlet and outlet tubes attached to the body of the main tube, with means for periodical change of the deteriorated "atmosphere" within the tube; but such means proved too troublesome. The present form of apparatus reaches the desired end, to a certain extent, by generating fresh carbon dioxide within the tube. A stick of some carbonate, such as calcium carbonate, is sealed in place within the tube, and heated by means of an enclosing metal spiral, this being heated by passage of a suitable electric current; the generation of the fresh gas is controlled by an electromagnetic valve. When the stick of carbonate is used up, the tube has to be uncoupled and returned to the manufacturers for recharging, which is, however, a simple matter. The life of a lamp, with one charging, is about 1500 hours.

Production of Lustrous Filaments, Films, etc.; Viscose

German Patent No. 450,242 (8/*X*/'27)—*H. Hawlik*—In the precipitation of the viscose silk in the spinning bath, when sulphuric acid is employed as the precipitating agent, the damage likely to result to the fiber has been avoided, more or less successfully, in various ways; Austrian Patent No. 67,113 chooses the precipitation under such conditions that the colloidal sulphur precipitating with the filament exercises some protective influence. Other methods (G. P. No. 287,955 and No. 324,433) accomplish some improvement by loading the bath with neutral salts, so as to depress the H-ion concentration; or (G. P. 260,749) by means of organic substances and zinc salts. The present process involves the use of cadmium sulphate in the bath; that is, cadmium sulphate as the principal active agent. Of the three examples given, the first prescribes a bath containing cadmium sulphate, 10 g., magnesium sulphate, 200 g., sodium sulphate, 200 g., and sulphuric acid, 140 g., in each liter of bath. The cadmium sulphide deposited upon the filament exerts a specially favorable protective influence; it can be easily removed from the fiber by mild oxidizing agents, such as nitrous acid (a bath of acidified nitrite); and the expensive cadmium thus recovered. It is claimed that the luster, tensile strength, and elasticity possessed by viscose silk thus prepared is not as yet attainable by any other process.

Dyeing of Acetate Silk

German Patent No. 459,823 (26/*IV*/'28) (*addition to G. P. No.* 446,541 *of* 28/*IX*/'24)—*I. G. Farben-Ind. A.-G.*—The original patent involved centrifuging or wringing, after impregnation with a bath containing a diazotized amine, a second component, and nitrite. The present modification simplifies the procedure and converts it into a one-bath process for developing the dyestuff in the fiber; the goods are worked in a bath, as before, containing the diazotizable amine, the second component, and nitrite, preferably with the addition of soaps, Turkey-red oil, etc., for a hot bath or suspension, as the case may be; then, adding to the bath, while the silk is still in it, an acid or acid compound, thus developing the dyestuff in the same bath. The first of the four examples describes the dyeing of 20 g. of acetate silk; the bath, of 500 cc. volume, containing 0.2 g. of amino-azobenzene, 2.5 cc. of sodium beta-naphtholate solution 1-10,25 cc. of Monopol Soap solution 1-20, and 25 cc. of sodium nitrite solution 1-10. The silk is worked in this suspension for about 30 minutes at 60°-70° C.; 25 cc. of acetic acid of 6° B. are then added, and the goods worked for 20-30 minutes further at the same temperature. The silk

is then rinsed and soaped. This dyeing is a full, bright red.

(It seems impossible, however, that one could avoid dyeings not fast to rubbing, if produced in this way, or could avoid losing more or less of the generated dyestuff in the bath, unless the use of a dispersing agent, such as the one mentioned, can bring about a thorough absorption of the dye-pigment (for that is, of course, what the color is) by the fiber. We have seen somewhere described and patented a "machine for producing dyeings fast to rubbing," which consisted merely of a series of rotating cylindrical brushes, over and between which the dyed cloth was led, until all dyestuff removable by brushing had been brushed off—which is by no means a method of dyeing fast to rubbing. It would be rather surprising if the dyeing process just described did give dyeings which would not require after-treatment with the "decrocking" machine just mentioned.)

Basic Dyestuffs (Triphenyl-methane Series)

German Patent No. 461,148 (24/V/'28)—*British Dyestuffs Corp., Ltd., E. H. Rodd and F. W. Lynch.*—Up to the present, the condensation of such ketones as Michler's ketone has been confined to such secondary and tertiary amines as possess a reactive hydrogen in the para-position (more exactly expressed, it is only such amines which do possess a reactive hydrogen in that position). The present patent accomplishes condensation by treatment of Michler's ketone, or a ketone of that type, with an alkali metal, and then with an aryl halide, in the presence or absence of a solvent or medium. The triaryl condensation is thus set up, and the product is already in condition to furnish dye-salts directly with suitable acids. In this manner, the third benzene ring of the dyestuff may bear other groups than the customary secondary or tertiary amino-groups. Five examples, with theoretical discussions, are given.

Sulphur and Its Compounds as Auxiliaries in Peroxide Bleaching

W. Fehre—Tinctoria 31, 119 (1932).—A paper of essay form, giving a general, very general, view of sulphur compounds as used in bleaching; working up, naturally, to sodium hydrosulphite. A number of facts are well expressed. A distinction is well drawn between bleaching by oxidation, which in general destroys the coloring matter of the fiber, breaking it down into simpler, soluble substances, and bleaching by reducing agents, which may be considered as transforming the coloring matter into a leuco form, soluble therefore at least in aqueous alkalies, if not water alone; and so removed, but not exactly destroyed, in the ordinary use of the word. This point may prove definitely, perhaps, sometime, to have some bearing upon the return of color to goods bleached by reduction with sulphur dioxide or sulphites (under which class hydrosulphite may be placed), instead of our being content to say that goods which have been sulphur-bleached "yellow" upon being stored.

Recent Progress in Hydrogen Peroxide Bleaching

E. Billot-Mornet—Tiba 9, 745 (1931)—A paper presented at the Congress of the International Federation of Textile Chemists and Colorists. Of general interest and nature.

NEW PATENTS

(*Abstracted by Synthetic Organic Chemical Mgrs. Ass'n*)

Production of Nitrogenous (Vat) Dyestuffs. (In which a pyranthrone radicle is combined with at least two anthraquinone radicles by nitrogen linkages; dye cotton fast shades from blue to violet or black.) Max Albert Kunz, of Mannheim, and Karl Koberle, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,859,742, May 24, 1932.

Pigment Dyes. (Being salts formed on the one side from an organic dyestuff containing acid salt-forming groups and on the other side from a cyclic organic base.) Georg Kranzlein, Christoph Hartmann, and Albin Hardt, of Frankfort-on-the-Main-Hochst, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,860,036, May 24, 1932.

Vat Dyestuffs of the Anthraquinone Acridone Series. (Prepared, for example, by reacting with a 4-halogen-anthraquinone acridone upon a monoacylated diamino-anthraquinone, causing carbazol ring formation by the interaction of concentrated sulfuric acid, and saponifying the acylamino group; dye cotton from an alkaline hydrosulfite vat strong reddish grey to black shades fast to chlorine.) Walter Mieg, of Opladen, and Robert Berliner, of Leverkusen on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,860,472, May 31, 1932.

Dyestuffs of the Tartrazine Series. (Comprises reacting sodium dihydroxy-tartrate with phenyl hydrazine-3.5-disulphonic acid; dye wool very greenish yellow shades fast to light and convertible into color lakes having an excellent covering power by treatment with metal salts.) Eugen Romig and Karl Holzach, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,860,478, May 31, 1932.

Manufacture of Triarylmethane Dyes. (Relates to improvements in the manufacture of lissamine green V (C. I. No. 735—U. S. Patent No. 639,977.) Thomas Arthur Simmons, of Huddersfield, Eng., assignor to British Dyestuffs Corp., Ltd., of Manchester, Eng., No. 1,860,753, May 31, 1932.

Stilbene Dyestuffs and Process of Making Same. (Comprises condensing the conversion products of para-nitrotoluenesulfonic acid with aromatic amino-compounds of the benzene and naphthalene series; dye cotton yellow, red-orange, orange, yellow-orange, orange-brown and red-brown tints.) Max Schmid, of Riehen, near Basel, Switzerland, assignor to Firm Society of Chemical In-

dustry in Basel, of Basel, Switzerland, No. 1,861,323, May 31, 1932.

Dyestuffs of the Stilbene Series and Process of Making Same. (A division of above Patent No. 1,861,323.) Max Schmid, of Riehen, near Basel, Switzerland, assignor to Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,861,324, May 31, 1932.

Azo-Dyestuffs Containing Copper. (Obtainable by causing an agent yielding copper, such as cupric sulphate, to act on an azo-dyestuff obtained by coupling in alkaline solution a tetrazotized 4.4'-diaminodiphenyl-3.3'-dicarboxylic acid with aminohydroxy-naphthalene-disulfonic acid; dye vegetable fibers blue to greyish-blue to greenish-blue shades of good fastness to light and ironing.) Winfrid Hentrich, of Leverkusen-on-the-Rhine, and Josef Hilger, of Cologne-Mulheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,861,917, June 7, 1932.

Brown Vat Dyestuffs of the Benzanthrone Acridine Series and Process of Making Same. Ernst Honold, of Frankfort-on-the-Main Fechenheim, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,861,921, June 7, 1932.

New Water Insoluble Azo-Dyestuffs. (Obtained by combining either in substance or on the fiber an aromatic diazo-, tetrazo-, or diazo-azo-compound with 2'3'-hydroxynaphthoyl-4-amino-acenaphthene; yield bluish-garnet color lakes, dyeings and printings.) Leopold Laska and Arthur Zitscher, of Offenbach-on-the-Main, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,861,926, June 7, 1932.

Metalliferous Dyestuffs and Process of Making Same. (Chromium compounds in particular; dye vegetable fibers and artificial silk blue, steel-blue and grey blue tints.) Fritz Straub and Walter Anderau, of Basel, Switzerland, assignors to Firm "Society of Chemical Industry in Basle," of Basel, Switzerland, No. 1,862,439, June 7, 1932.

Process of Making Sulphur Dyes. (Comprises the improvement of heating the reaction mass in a rotating ball mill.) Joseph M. F. Leaper and Raymond W. Hess, of Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., of N. Y., N. Y., No. 1,862,575, June 14, 1932.

Manufacture of Red-Orange to Brown-Red Basic Dyestuffs of the Acridine Series and the Products. (Based on the ordinary acridine-orange manufacturing method, which consists in treating tetraalkyladiamino-diphenylmethane with an excess of nitric acid, reducing the nitro compound thus obtained and oxidizing the resultant leuco compound to the dyestuff.) Manfred Alioth, of Basel, Switzerland, assignor to Durand & Huguenin S. A., of Basel, Switzerland, No. 1,863,233, June 14, 1932.

(*Black*) *Vat Dyestuffs.* (Obtained by allowing the diazo compound of the aminobenzanthreone to act on an alkali metal xanthate and treating with a strong alkaline agent.) Paul Nawiasky, of Ludwigshafen-on-the-Rhine, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,863,668, June 21, 1932.

Polymethine Dyestuffs (Of blue to green shades; obtainable by causing a pyridinium salt, the nitrogen atom of which is labile, to react upon a 1.3.3.-trialkyl-2-methylene-indoline.) Ottmar Wahl, of Leverkusen-on-the-Rhine, Ger., assignor to General Aniline Wks., Inc., N. Y., N. Y., No. 1,863,679, June 21, 1932.

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